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Electrical World

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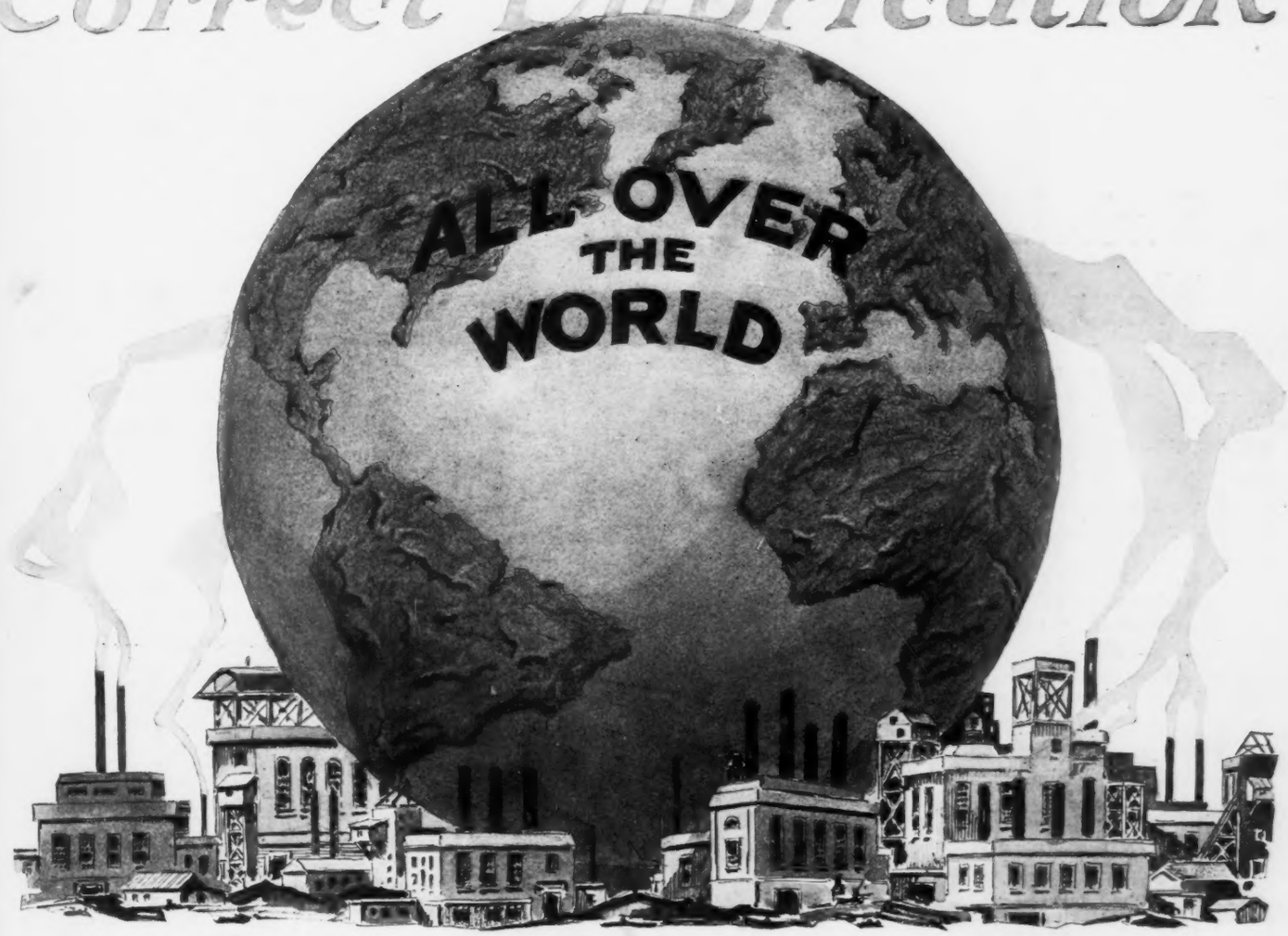
Correct Lubrication



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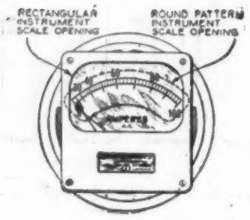
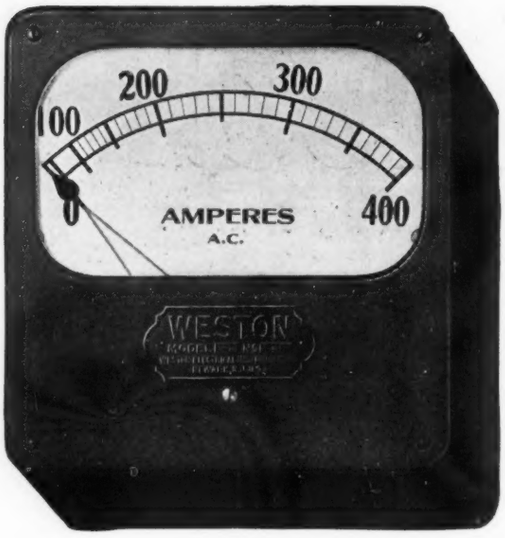
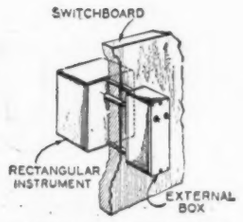


Same Scale Length — The Length of scale is equal for both the round pattern, 7½ in. diameter instruments and these new rectangular types. This is in spite of the reduced over-all width and height of the new rectangular case.





Layout of Rear — External boxes, where required, occupy less space than the instruments. The boxes are compact and are designed to be mounted on instrument mounting bolts.

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With these instruments, space requirements are radically reduced—in some cases by nearly one-half. Thus they allow more room for other devices while they cut down the space occupied by instruments.

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The really wonderful thing is to obtain Weston Instrument Service in a more economical case design. As compared with the former round pattern type, the space saving in square feet for a four-circuit panel is in the ratio of 5 to 9. Because of this fact alone, designers are giving these instruments the closest attention. Standard specifications are being revised to permit of their use. Our new booklet 1504 especially prepared for you gives all the details. A copy will be sent promptly on request.

Weston Electrical Instrument Co.

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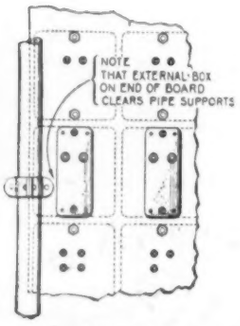
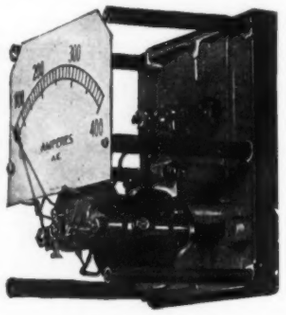
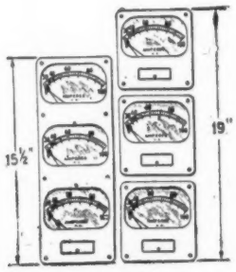


Studs—All studs are arranged approximately on the approximate center axis of the instruments to clear pipe supports. This is especially important with instruments located at ends of switchboard.



Removable Case — The case is arranged for quick removal without dismounting the instrument. The operation consists merely of removing four very accessible screws on the front of the case.



Triplex Ammeter — The triplex ammeter allows an even greater saving than the single dial instruments. It saves 3½ inches in height over the three instruments it replaces.

Electrical Indicating Instrument Authorities Since 1888

WESTON

Electrical World

The consolidation of Electrical World, Electrical Engineer and American Electrician

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W. H. ONKEN, JR. Editor

HAROLD V. BOZELL Editor

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Low Money Rates and Public Utility Financing

ONE outstanding feature of the stock market during June was the showing made by public utility stocks, particularly those of electric light and power companies. In the midst of depressing industrial and political conditions the rise in the utilities stood out in marked contrast. The decline in the rate for money also acted favorably on the bond market. When gold is plentiful almost any fair bond becomes attractive and consequently commands a higher price. Such a situation in the money market offers opportunity for important operations in new securities and refunding. Just now public utility bonds and stocks are in high favor because of the rate they pay, the assurance of continued earning power due to the stability of the industry and the safeguards which commission regulation throws around the investment. There has been a perceptible drift on the part of investors toward electric light and power securities for some time and present conditions have merely accelerated buying. The situation is not likely to change until after the general election, and though foreign flotations may absorb some of America's surplus gold, public utility operators should not permit opportunities for cheaper money to slip through their fingers. Fashions in bonds change as do fashions in clothing. The electric light and power industry has only high-grade issues to offer, and under present money market conditions these as well as preferred and even common stock should find a ready sale.

Advances Recorded and Problems Indicated

AT THE A. I. E. E. convention in Chicago some notable papers were presented and discussed. These papers, which are abstracted in this issue, were on a variety of subjects, but taken as a whole represented an encouraging record of progress in the art of electrical engineering.

The group of papers on the metropolitan distribution system indicated a decided trend toward the elimination of direct current and the substitution of a four-wire alternating-current network in its place. This solution is dictated by both engineering and economic considerations, and there remain only questions of detail in the development of adequate apparatus to render equivalent service with alternating current. Much progress along this line has been recorded, and there appears to be no inherent obstacle to commercial success with the alternating-current system.

The automatic principle has been developed and applied for a sufficient time to indicate its success for substations and generating stations. The technical results are splendid, and only further economic analysis is necessary to place the automatic station more universally in its allotted field of application. In railway work, in direct-current and alternating-current substations and in hydro-electric stations the automatic principle has been applied successfully, and its wider adoption and more extensive development are only a question of time.

The outstanding feature of the Institute meeting to many was the series of completed and proposed standards presented under the auspices of the A. I. E. E. standards committee. Good work has been done toward fixing past accomplishments so that future progress can be guided in their light, and the thanks of the industry are due the various sub-committees, which have worked unselfishly and unstintedly. Other developments in machinery and in electrical science were described at the sessions, and the convention again proved the power and influence of the professional engineer in guiding and making possible the triumphs of the electrical industry.

The President of the N. E. L. A. Selects His Cabinet

THE spectacle of a Republican governor with a Democratic Senate or Assembly, or vice versa, is not an unusual one. Only too well do the American people know that very little constructive action proceeds from a hybrid government of this kind. Either there is a complete deadlock or, where experienced politicians are in the saddle, a compromise based on political and party bargaining. Neither outcome is conducive to harmony and progress.

It is evident that the National Electric Light Association had this fact in mind when it changed its constitution to make all chairmen of the national sections appointees of the president. Whatever the impelling motive, it is certain that the move is a wise one. Now experienced and competent men who have served the association in some capacity and then have retired and, so to speak, sat on the side lines can be drafted back into the service. The president can surround himself with men of his own choosing who will follow his policy with unanimity and singleness of purpose. This is a great asset in any organization. In fact, one can imagine the confusion and impracticability of a business corporation headed by a president and several vice-presidents and with chairmen over each department elected by the men in that department.

By the new plan responsibility is centered in the president. Franklin Griffith's appointees, announced in this week's ELECTRICAL WORLD, commend themselves to the industry. With the eyes of the country focused on the public utilities, they must show virility, initiative and enterprise. New blood is necessary to insure these, and so is old blood to guide and temper when experience so dictates. The new organization of the N. E. L. A.

permits young and old to serve side by side and ought to result in an association of still greater accomplishments. Considering the record already made, this is no simple task, but the job will be done.

Stabilizing Water Control in Hydro-Electric Stations

ONE result of interconnection, among many good outcomes, is the opportunity it affords hydro-electric plants in a network under co-ordinated control to make more efficient use of a watershed in meeting load requirements than is usually feasible in singly operated stations. Where a number of such plants are established in what might be called "hydraulic series" on a single river, as in the New England Power Company's Deerfield stations, the provision of pondage above each station is helpful in stabilizing the flow under a single scheme of load dispatching and tends to insure a more accurate control of the water than where the downstream run is allowed to go through the wheels of a single station and where water is spilled over a single dam with little or no regard to future use. Each new plant of suitable capacity added to a series development makes it easier to handle the total flow effectively because of the additional pondage resulting under reasonably favorable conditions, and also through the flexibility of load assignment offered the dispatchers having two or more plants under their electric and hydraulic control.

The best standards of water control in such stations demand the centralization of responsibility for the starting and stopping of waterwheel units at the dispatching office. The same condition applies to the control of reservoir and pondage draw-down, with close supervision of the height of flashboards permitted under various conditions. Along with high-grade operation go continuous charting of stream flow and gage readings, reliable instrumentation of loads and heads of water, tailrace gages and close relationship with weather-forecasting facilities in the territory. The installation and maintenance of satisfactory governor equipment is another factor of great importance in cutting down waste of water. All these must be coordinated with the aid of a thoroughly reliable communication system, and except under extreme conditions local plants should not undertake to decide the extent of their use of water without approval of the operating headquarters.

Quick action is sometimes necessary in handling flashboards in a series installation of plants not far apart, and with all the care taken to keep in touch with weather conditions over a wide area it is sometimes very difficult to avoid waste of water. A sudden thunderstorm or a cloudburst in the hills between two stations may not be forecast in time to obtain instructions from headquarters. Experience in handling neighborhood ponds comes into play here and offers considerable chance for local initiative in saving water. Exhaustive study of operating conditions, however, by the entire operating organization offers a more satisfactory program with which to meet most emergencies, and as the years go by the prospects of reducing the control of water to more precise limits increase. The field is one of great fascination to both hydraulic and electrical engineers.

Prizes Which Should Not Go Begging

IN ORDER to quicken and stimulate interest in the electric light and power industry there have been established numerous prizes for papers treating on certain phases of the business. Four of these are administered by the National Electric Light Association and are known as the Doherty, Billings, Smith and Byllesby prizes, the latter two being the more recent. At first there was keen competition for the prizes owing to the many aspirants. Of late, however, these contests have been comparatively neglected, the membership apparently either forgetting that there are such rewards available or showing no interest in them. At the Atlantic City convention there was no competition for any of the prizes, and in the case of the Billings prize no paper was offered at all.

As a result of this decline in interest it has been decided to create a prize awards committee which will supersede all of the other award committees and to whose decision all of the prizes except the Coffin prize will be subject. There is no reason why these prizes should go begging. Their monetary value alone should induce employees of companies to make an effort to win them. Every contender would be the better for the effort even if he were unsuccessful. A great service would be rendered if the secretaries of the several geographic divisions would stimulate interest in the awards and obtain papers for the consideration of the prize awards committee. The committee itself will doubtless make a special effort to interest employees in the prizes, and the next convention should witness a veritable shower of papers of exceptional merit.

Self-Luminous Traffic Signals

THE question of traffic control by signals is receiving a great deal of attention. In fact, judging by the great variety of traffic signals in use, they are receiving attention from too many persons not particularly qualified for passing upon an intricate matter involving light, color and vision. One finds police departments, city officials and others unfamiliar with the principles involved gravely experimenting and blandly passing judgment. In reality there are perhaps only a few experts qualified to discuss this complex matter. It is encouraging to know that certain national bodies have the situation under review. In the meantime, however, those interested in lighting should take a hand in their own localities. Central-station men will often find themselves in a strategic position for helping to guide developments in the direction that they should take.

Form and color are the chief fundamentals of a signal. These can be satisfactorily incorporated in a self-luminous device. Form alone is of very doubtful value because a signal should be recognizable at a reasonable distance. Many persons have vision so defective that they cannot accurately distinguish form at a distance, but the same difficulty is not found in the recognition of color. There is a tradition to the effect that about four per cent of the people are color-blind, but this statement is misleading. Two colors, red and blue-green, can be chosen which admirably suit the requirements. The best authorities believe that

not more than one person in a hundred thousand would have difficulty in distinguishing between these two colors. However, it is likely that a thousand times more persons have eye defects so serious as to make form unrecognizable at a moderate distance. Furthermore, fog, rain, smoke and dust often obliterate form when under the same conditions a powerful self-luminous color signal would still be seen as a spot of colored light. Even the selective transmission of fog, smoke and so forth cannot alter these two colors sufficiently to cause them to be confused at any reasonable distance.

Red and blue-green meet the requirements of "stop" and "go" respectively, but many, and with good reason, lean toward the use of an "interval" signal for the purpose of clearing matters before the next signal is flashed. Light yellow, such as canary, is a logical color for this use. After utilizing these colors form may be introduced in many ways. This may be desirable in some cases even at the risk of complication. However, for general traffic requirements no better pair of colors could be found than red and blue-green, and if an interval signal is desired, yellow is the best hue. These are the conclusions of men who are eminently qualified to render an opinion. Experience is proving that self-luminous signals of these colors are entirely satisfactory. It is hoped that standardization and general adoption of this scheme are near at hand.

Bobbed Hair as an Example of a Popular Fad Market

IT IS said that five thousand women are having their hair bobbed in New York City every day at the present time. This figure is the result of an investigation by a metropolitan newspaper. One effect of this fad throughout the country is to bring a tremendous market to the manufacturers of electric curling irons. One Middle Western company alone, for instance, reports that it is at present receiving orders totaling daily more than twenty thousand for a certain type of curling iron—and there are many other makers. So great is the influence of a popular demand upon the production of any device.

It is because the electrical industry is so young in this popular market that such figures seem spectacular. As a matter of fact there is nothing uncommon in it. A certain type of bead necklaces, fashioned for socket pull chains, becomes the vogue—as happened not long ago—and a whole factory is soon engaged grinding them out until the shopper's fancy turns to something else. So it is in clothing, sporting goods and other lines. So it will be with electrical merchandise as it steadily comes into more universal use. At any time some social fad may bring exaggerated demand for a teapot or a toaster or a certain type of lamp or some other present or future device.

The central-station sales department and the electrical dealer, as well as the wholesalers and producers, have not yet learned to feel the popular market pulse quickly and play to a fad as they do in other older industries. Bobbed hair presents an opportunity in every community. The day will come when such a situation will be met with the keenest kind of selling activity by every retailer of electrical appliances. It will mark another stage in the commercial development of the electrical industry.

"Our Business Is Everybody's Business"

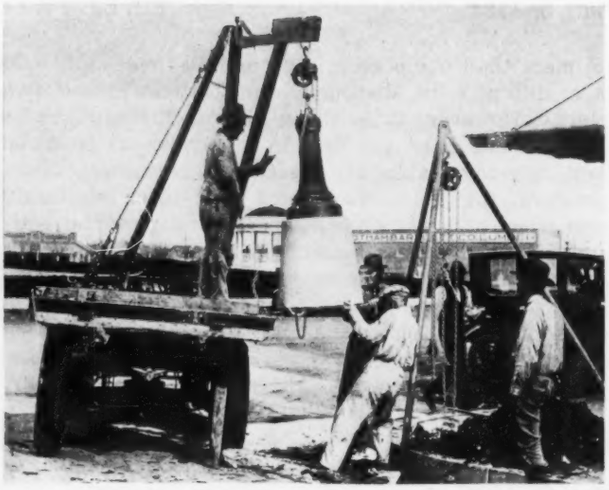
MANY public utility companies have found from past experience that more seeds of discord are sown by limiting the type or amount of information made available for public consumption than by establishing the policy of "Our business is everybody's business." Where this policy has not been in existence companies have sometimes had their fingers burned by unscrupulous persons distorting facts that have not been fully made public, but not a case is known in which proper frankness in the first place would not have prevented the trouble. Malicious or disaffected persons have always garbled and will always garble information of which they get wind, but the fact remains that if nothing be concealed the public as a whole, which wants to be fair, will not be influenced by false statements.

Failure to recognize this fact evidently makes some companies hesitate to start the open-book policy. How can they guard themselves against the thing which they fear?

According to the composite experience of utility companies the first step is to adopt sincerely some such motto as "Our business is everybody's business." This should be emphasized in newspaper advertising, first by outlining what it means and what it is intended to do. Later, in subsequent advertising, it can be used as a "slogan" with the company's name. It should be used on conspicuous posters around the company offices or showrooms, where it will command the attention of the public, and on all communications. Next, companies agree that this policy should be impressed on employees and that steps should be taken to educate them concerning all lines of the business which involve service, policy or public contact by periodic meetings or lecture courses. It is possible that until the employees have been educated certain authorized sources of information will have to be established, but these should be as many as possible and the employees should be instructed to refer people to them, not because subordinates are not allowed to talk, but because they want the public to get the facts straight.

After these preliminary steps are taken, some publicity program is usually established through newspaper advertising, circulars, stickers on bills, etc., picking subjects for explanation that the public does not understand, like service policies, raising money, utility regulation, ownership of securities, etc. Each advertising effort along this line should not only be labeled by a "snappy" heading but should be identified as "Step No. — of Our Attempt to Make Our Business Everybody's Business," to indicate that it is one of a series and not complete. Later these essays can be compiled in booklet form, if desired, to give to any one who wants them or for educational work upon a more elaborate scale. As a fitting counterpart of such a program, every newspaper editor should be told personally of the company's willingness to explain any phase of its business and should be invited to come to headquarters for information.

Such a policy cannot help but establish public confidence as any number of companies that have followed it in one form or another will testify. Until every utility adopts it, however, the good work now being done along this line will not have its complete effect as a national constructive influence.



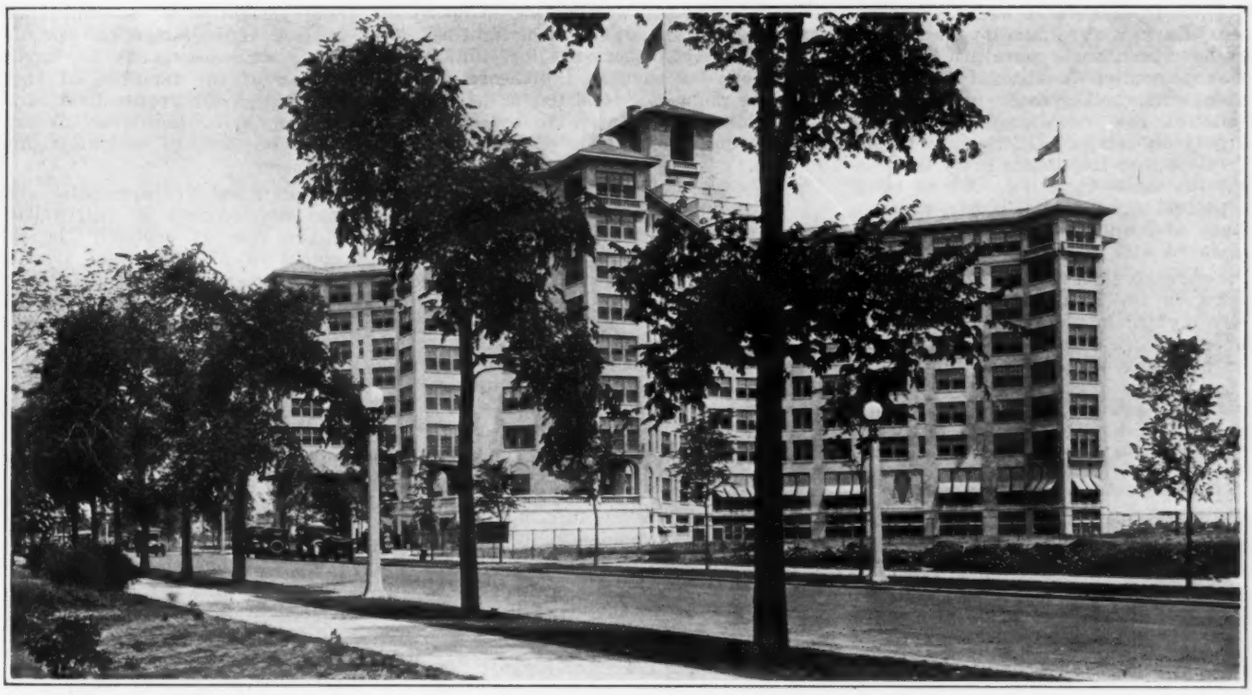
Lighting a Texas City

INSPIRED by pride in its excellent system of paved streets, the city of Abilene, Tex., has recently finished the installation of a "white-way" system that covers slightly more than seven miles of business and residential thoroughfares and gives what is pronounced one of the most modern and complete street-lighting plants to be found in any city of similar size in the Southwest.

There are 342 ornamental steel standards in the "white-way" equipment, each containing a 250-watt lighting unit. In addition, the streets in sections of the city not covered by the "white way" have been equipped with 169 bracket fixtures, making a total of 511 new street lamps installed through a single contract. Approximately $100,000 is invested in the new lighting system.

In building her new street-lighting system Abilene demanded that strength and durability be combined with beauty. The heaviest type of pressed-steel standards have been mounted on massive concrete bases which are proof against almost any kind of a shock. These concrete bases measure 30 in. in diameter at the base, 24 in. in diameter at the top, and stand 30 in. high. Each base weighs a ton and a half and is set well into the ground with steel and concrete underpinning.

Upper left—Old and new types of lighting standards. Upper right—Setting half-ton concrete bases. Center—Pine Street at dusk. Bottom—Day view of Sayles Boulevard (center parkway).



Annual Convention of A. I. E. E.

Chicago Meeting Scores Even More Than Usual Success—New Machines Described—Cable Situation Discussed—Status of Automatic Stations Presented—Problem of Metropolitan Distribution Outlined

MORE than one thousand electrical engineers and their friends attended the annual convention of the American Institute of Electrical Engineers in Chicago on June 23-27. Several new machines were described and discussed, papers on high-voltage cables were presented, and the urgent necessity for cables for operation at 132 kv. was made plain. A very great interest in automatic substations and generating stations was evident, this phase of the art having reached a plane where it was possible to express great satisfaction over the results obtained. At the meeting devoted to standards certain sections of the proposed revision of the A. I. E. E. Standards were presented for discussion and A. W. Whitney of the American Engineering Standards Committee gave a splendid address covering the philosophy underlying all standardization. In all, more than thirty papers on many and diverse topics of interest to the electrical engineer were presented and discussed at the convention.

The local committee had perfected complete arrangements at the Edgewater Beach Hotel, and, as reported in last week's news report of the convention, a continuous series of trips and entertainments for the delegates and the ladies accompanying them added to the enjoyment of the meeting. Owing to illness President H. J. Ryan was unfortunately unable to be present, but the convention was ably conducted by Vice-president R. F. Schuchardt, assisted by the other vice-presidents and by President-elect Farley Osgood.

On Monday, as stated last week, the section delegates met under the leadership of Chairman A. W. Berresford and discussed section problems and policies. Three sessions were held. President-elect Farley Osgood said that the sections were vital parts of the Institute and that the growth of the Institute was due to the effective work of the sections. E. H. Hubert outlined methods for aiding sections to obtain speakers or papers after each section has planned its work for the year. An informal discussion occurred in regard to the use of financial budgets, making programs and bringing about greater co-operation between sections and between sections and headquarters.

A feature of these meetings was a discussion of the regional or district meeting so recently introduced in District No. 1. Prof. H. B. Smith and L. E. Pierce told how the Worcester (Mass.) meeting was organized and conducted, and several members commented on the very successful meeting held in that city in June. The delegates passed a resolution commending the idea of the regional or district meeting and advocated the appointment of a special committee of the board to study its possibilities.

Some discussion took place on the possibilities of closer co-operation of the membership committees of sections and the board of examiners. The sense of the meeting that each section should appoint a program committee in order to bring about greater responsibility, co-operation and uniformity in the section was also made evident.

Technical Committee Reports

Following are brief summaries of the reports of the technical committees, presented on Tuesday morning:

Industrial and Domestic Power.—The committee on industrial and domestic power (H. D. James chairman) said that control apparatus had been receiving increased attention since the realization that the success of many applications of electric drive depends upon selecting suitable control equipment. To a great extent the unit parts of control equipment are being standardized and a number of combinations are being eliminated. During the year some interesting applications and some new apparatus have been placed on the market.

Protective Devices.—The committee on protective devices (H. R. Woodrow chairman) had studied lightning arresters, oil circuit breakers, switches and fuses, relays, automatic stations, current-limiting reactors and grounding of systems. The chief work on lightning arresters was to prepare and agree on a basis of comparing performance.

A definition of the interrupting duty of an oil circuit breaker has been agreed upon by the A. I. E. E., the National Electric Light Association and the Electric Power Club, and manufacturers are prepared to rate all new

breakers in accordance with this definition. Bushing-type current transformers have been made more practical for relay protection because of recent developments, and greater use is being made of the indicating pointer and targets on relays. Of the new types of relays, the impedance relay is probably the most promising. A new relay to protect against open-phase, reverse-phase and unbalanced-phase has been produced and shows good application.

Iron and Steel Industry.—Developments in the iron and steel industry were divided by the committee on that subject (F. B. Crosby chairman) under the headings of generating units, distribution, yard electrification, electric furnaces, electric heating, automatic control, main-roll drives and arc welding. The steam turbine still holds first place as a prime mover, the committee said, although a combination of gas engines and steam turbines often makes an ideal steel-plant generating unit.

Transmission and Distribution.—The committee on transmission and distribution (Frank G. Baum chairman) reported that interconnection and the development of hydro-electric power have involved many transmission problems not met in previous operating practice, owing to the distances involved, the amount of energy transmitted and considerations of reliability and voltage. Although considerable progress has been made in the design and the manufacture of the suspension-type insulators, there still remains room for investigation of the electrical and mechanical defects influencing leakage resistance, deterioration, etc. Some flashovers are still unexplainable, and research is being conducted to determine the cause and cure. Mechanical stress due to continued loading, vibration of aërial spans, temperature, humidity and atmosphere conditions requires further study. Experience on the 220-kv. transmission lines in California has been very encouraging. There is a tendency toward higher voltages for urban distribution, making it necessary for the development of more economical and efficient types of apparatus. Progress is being made in the development of transformers with reduced core loss for rural service. Aërial construction is being standardized. Since cable specifications of the N. E. L. A. and the present standards of the A. I. E. E. do not insure satisfactory cable for the higher operating voltages, studies are being made by the manufacturers and users to bring about changes in manufacturing processes and materials and to devise a method of testing high-voltage cable.

Lighting and Illumination.—Substantial progress was announced in the report of the committee on lighting and illumination, of which G. H. Stickney was chairman. There has been a rapid acceleration in the application of improved lighting, and the year stands out as one in which standards have been raised rather than as one of engineering development. Manufacture of lamps has been adapted to the demands, with the result that prices are at least 30 per cent below those of 1920. Practically all tungsten lamps are being made without tips, and bowl-frosted lamps are widely used in open reflectors and shades for home lighting. The efficiency of present-day illuminants falls far short of the theoretical ideal the committee reported, and there is considerable incentive to investigators to improve methods of light production.

Power Stations.—A very long report was submitted by the power stations committee, of which Nicholas Stahl was chairman, devoted chiefly to a résumé of the year's progress. The most impressive feature of the year's work was the unusually large building activity in both steam and hydro-electric plants (approximating 5,000,000 kva.) and the continued tendency toward larger stations and larger units. Many schemes have been introduced to increase steam-plant efficiencies, and fuel oil and pulverized coal have received a strong impetus. The sizes of boilers and furnaces are rapidly increasing, and there is a tendency to increase heating surface exposed to radiant heat. Various superheater developments have been made, and economizers are again coming to the front. Higher steam pressures and new heat cycles are being tried, the highest pressure being 3,200 lb. in England. Completion of a mercury turbine was one achievement of the year. The development in hydraulic-plant equipment has followed the general trend of steam plants, both in improvement of design and construction and in the size of units. The tendency in large hydro-electric stations is toward a single-floor station.

Research.—Activity in the field of electrical research has been very pronounced in the past year and has covered a wide range of subjects, J. B. Whitehead, chairman of the committee, reported. In the field of molecular physics notable progress has been made in ascertaining the nature of the structure of the atom. Special mention was made by the committee of the intensive studies which have been carried on in the field of magnetism and high-voltage insulation.

Telegraphy and Telephony.—Developments in the field of telegraphy and telephony were indicated by the chairman of the committee, O. B. Blackwell, chiefly by referring to the papers which have been presented on these subjects before the Institute during the past year. Among the developments to which he called particular attention are the step-by-step automatic telephone equipment, the measurement or transmission efficiency, an electrical frequency analyzer, treating existing pole-line timber, cable telegraphy and factors affecting its speed, a radically new type of ocean cable, high-quality reproduction of radio messages, use of short wave lengths for rebroadcasting, long-distance radio-telephone tests, studies of static interference, carrier-current telephony over power lines, supervisory signaling systems and transmission of pictures over telephone lines.

Educational.—The outstanding event in the field of engineering education during the past year, according to the committee (W. E. Wickenden chairman), has been the inauguration by the Society for the Promotion of Engineering Education of a comprehensive project of investigation and development, with provisions for active co-operation of the faculties of engineering colleges, the professional societies, the employing industries, federal and state bureaus of education and other agencies.

Instruments and Measurements.—The principal development in instruments during the year is probably the announcement of a commercial type of kilovolt-ampere-meter, the committee on instruments and measurements, of which G. A. Sawin is chairman, reported. The tendency is toward the use of small indicating instruments. A number of operating companies have installed systems of remote metering and totalizing of power readings. Bottom-connected meters are finding considerable favor.

Mines.—The most urgent requirement in the mining field today, according to the report of the committee on mines (F. L. Stone chairman), so far as electrification is concerned, seems to be the need of a satisfactory code for the safe installation of electrical apparatus underground. Such a code has been prepared by the American Mining Congress and the Bureau of Mines and is on the way to the Engineering Standards Committee for final approval.

Electrical Machinery.—Careful consideration was given to the basic principles underlying machine standardization by the committee on electrical machinery, of which H. M. Hobart was chairman. Propositions have been drawn up to distinguish more clearly between ratings and service conditions. The history leading up to the present practice in rating was outlined in the report and followed by definitions of usual and unusual service conditions and recommendations for applications under these conditions.

Electrochemistry and Electrometallurgy.—Of all the electrochemical and electrometallurgical process in which progress has been made during the past year or two, the one of greatest interest and greatest possible future value to electrical engineers is that of electrolytic iron. This was the outstanding point in the report of the committee. (J. L. McK. Yardley chairman.)

Marine.—The marine committee (G. A. Pierce chairman) reported that electricity is now almost universally recognized as the future power for ships' auxiliaries outside of machinery spaces, for all auxiliaries in Diesel-engine-propelled vessels, and for portions of the engine-room auxiliaries in steam vessels. Attention was called to the importance of some action to insure proper maintenance of electrical apparatus on shipboard. Recommendations are being made regarding the type of apparatus and control for various auxiliaries.

Automatic Stations

THE application of the automatic principle to stations and substations was the theme of six excellent papers at the Wednesday technical session conducted by the protective devices committee. The place and re-

quirements of automatic control in hydro-electric plants was of particular interest.

The principles connected with the application of automatic substations for use in conjunction with the Edison direct-current system were indicated by C. W. Place. Most of the large cities have about reached the point where human limitations will interfere unduly with continuity of service, and there are prospects that the automatic substation will increase the reliability of the service because with it all the precautions against injury to apparatus can be taken without keeping away from legitimate loads, because interrupted service can be restored at the earliest possible moment, because losses can be cut down by installing more stations than would otherwise be economically possible, and because the operating force can devote its attention to maintaining the alternating-current supply.

An automatic self-restoring-circuit alternating-current substation for the supply of service in a high-grade residential suburb of Cleveland was described by H. L. Wallau. This station was put in commission in the latter part of 1920 as a manually operated station, and upon the completion of the installation of the necessary relays the operator was withdrawn and its operation as a full automatic substation begun toward the latter part of January, 1921. The operating results obtained in this station have been most gratifying, and other stations of this type will be installed in such locations as may warrant them.

The balance between the cost of operators' wages and the additional fixed charges and maintenance expense due to equipment installed in excess of what would be required for a manually operated station will be reached with the number of circuits planned and will lie between 9,000 kva. and 12,000 kva. of peak load, depending upon the average peak load carried per feeder.

A general résumé of the application of substations to 1,500 volts direct-current railway electrification was given in a paper by C. A. Butcher. The paper discussed the power requirements, the location of substations, their capacity, the selection of converting equipment, and then went into some detail as regards the service requirements of the substations and the control and operating equipment that had been developed to satisfy the existing need.

A two-unit automatic station supplying power to a three-wire, 250-volt direct-current Edison network was described by H. Bany. A general description was given of the service requirements, the machines used and accessory devices, as well as the principles of the automatic operation employed in controlling the machines and the method of protecting against emergency conditions. Experience with this station on the system of the Indianapolis Light & Heat Company has been very satisfactory.

Some operating experiences with automatic equipment on an Edison system were given in a paper by F. D. Wyatt. Conclusions after several stations had been installed were to the effect that the automatic synchronous motor-generator sets are equally reliable with the manually operated machines under normal conditions and much more reliable under disturbance conditions. The semi-automatic control applied to synchronous converters reduces the duration of the resultant disturbances on the direct-current system caused by voltage dips on the alternating-current system, and both kinds of automatic converter equipment reduce the duty of standby batteries materially.

Present practice in the automatic operation of hydro-electric generating stations was described in a paper by R. J. Wensley. The whole subject was treated in the paper, which told the present status of the art, including hydraulic development, types of wheels, operation with respect to the rest of the system and the details of the positive control and protective devices now available. The author accented the fact the cost must be minimized and that operating reliability was the great feature of automatic station developments.

The principal requirement of automatic control in hydro-electric stations, declared W. M. White in a written discussion, is to maintain the proper position of the waterwheel gates without subjecting the system to any shocks. Where small machines are connected with large systems crude control is not so serious as it is in large plants. Automatic control has been placed in manually operated stations, the author asserted, to insure reliability and centralization of control. For example, one switch can be made to control all the functions requisite to shutting down a unit, governor settings can be remotely controlled, and the forebay levels can be indicated at a distance.

Automatic operation is adapted to small plants, F. R. George thought, but can hardly be adopted in large plants to the entire exclusion of operators. On the Pacific Coast, Mr. George said, the water-power plants are normally the base-load plants.

C. W. Place maintained that the application of automatic control to hydro-electric stations will put base-load and peak-load stations on a different basis. The easiest way of storing energy is in the pond, he declared, and the easiest way to put power on the system during peak load is through automatic operation.

The so-called synchronous-motor drive for governors was referred to by P. B. Woodward as being the most simple, compact and reliable. No user has been heard of who has changed back from motor-driven governors to belt drive, he declared. He also expressed the need for brakes to hold the waterwheel gates closed when the machine is not in operation.

Automatic operation makes available for economic development the small water powers which could not otherwise be used, L. F. Harza pointed out. He expressed the belief, however, that automatic operation cannot justify the breaking up of heads because of the relative cost of small and lumped power developments and the advantages of lumping.

Applications of automatic control to substations was discussed by several speakers. V. E. Thelin referred to some simplified substations which have been used by the Chicago surface lines for three years without any inspection or maintenance. Trouble has been experienced only with one contact finger and a clock. The speaker favored shunt-wound rotaries and no shunts on the circuit breakers.

G. I. Wright announced that the largest automatic substation now contemplated for railroad electrification consists of two 2,000-kw. units. Suburban lines would involve four or five such units. Full automatic operation is not considered advisable by the speaker, although reclosing and automatic starting and stopping switches are considered desirable.

Precaution will have to be taken to prevent lock-out of motor generators and rotary converters on flashovers, especially with third-rail systems, if continuity of service is to be expected from automatic operation, declared A. M. Garrett. Manually operated substations will be employed on the Chicago Terminal electrification of the Illinois Central Railroad, but they have been designed so that they can be converted to automatic operation if this becomes desirable in the future.

A. C. Grayson claimed that Newark, N. J., has the largest combined automatic railway and power substation in the country and that it is noise-proof. Fourteen new automatic substations are under construction by the Public Service Electric Company of New Jersey for commercial, railway and combined commercial and railway service. It is expected that reclosing feeders, breakers and supervisory control will be installed in the manually operated substations as they are rehabilitated.

Within thirty days the Detroit Edison Company will have 33,000 kw. in automatic substations, 16,000 kw. of which was installed this year, nine stations having General Electric equipment and seven Westinghouse, according ing to J. W. Bishop.

W. H. Milan recommended that synchronous-motor generators should be kept on the line regardless of line voltage. He questioned the advisability of leaving batteries on a continuous trickle charge at 0.3 amp. because it disintegrates the grids. The value of emergency lock-outs on circuit breakers was also questioned because it would prevent the burning out of short circuits that occur on the system.

J. Lester Woodbridge pointed out that the six-minute rate of discharge is the economic limit of discharge for batteries and this determines the size which should be selected for service.

Electrophysics and Telephony

AT ONE of the parallel technical sessions on Wednesday morning papers on a variety of topics were presented. Electrophysics, telephony, radio and the temperature rise of machines were treated and discussed.

The behavior of selective circuits when subjected to irregular and random static interference and the devising of a practically useful figure of merit for comparing circuits, designed to reduce the effects of this type of interference,

were treated in a paper by John R. Carson. It was stated that even with absolutely ideal selective circuits an irreducible minimum of interference will be absorbed, and this minimum increases linearly with the frequency range necessary for signaling. Little, if any, improvement can be expected over the present form of wave filter as regards static interference as it approximates quite closely the ideal selective circuit. It is useless to employ extremely high selectivity to prevent static or random interference. The gain as compared with circuits of only moderate selectivity is very small and is inevitably accompanied by disadvantages, such as sluggishness of response, with consequent slowing down of the possible speed of signaling.

A new transmission unit other than the standard mile of cable unit was proposed in a paper by W H. Martin. The attenuation either of power or current corresponding to the mile of standard cable is directly proportional to the square root of the frequency of the term under consideration. This means that the standard cable mile corresponds not only to a certain volume change in the reproduced sound but also to a distortion change. This twofold effect of standard cable is desirable on most commercial circuits, but at present many types of circuits are being used which have much less distortion than standard cable. Moreover, it has become the general practice to determine the efficiency of circuits and apparatus on the basis of measurement and computations for single-frequency current. This makes it desirable to have a unit for expressing transmission efficiency, which is distortional—that is, is not a function of frequency. The transmission unit has been chosen so that two amounts of power differ by one transmission unit when they are in the ratio of 10^{-2} and any two amounts of power differ by N units when they are in the ratio of $10\ N^1$.

Mr. Carson, in answering a question as to whether electrical engineers were forever to be confronted with the problems of static interference, said that selective circuits would not eliminate static in radio and that wave filters approach the ideal circuit in the elimination of interference and static.

In the discussion aroused by Mr. Martin's paper it was shown that the transmission unit fitted into the preferred-number system.

A new relay working on the electron principle was described in a paper by George Lewis. This relay is sealed in a vacuum tube and takes advantage of electronic conditions for its operation. It can be used for many purposes, for example, as a call device for radio or carrier-wave circuits for either telegraphy or telepathy.

In discussing Mr. Lewis' paper Joseph Slepian of the Westinghouse Electric & Manufacturing Company showed how, in making the relay tube compact and small, some of the desirable characteristics of the elements must necessarily be modified. This is particularly true of the detector or cathode element. However, the selective response anode made of "Nichrone" gives a high reactance which is desirable for sensitiveness. At first thought it might appear that the control contact operating in a vacuum would last a long time as sparking is, thereby, prevented. But previous investigations show that this is not the case because the contacts, just as they are opening, take all of the voltage of the circuit. This causes them to become very hot. Actual tests have showed that if there is a potential of one voltage across some of the contacts now in use, a temperature as high as 3,000 deg. F. is reached which will soon result in roughened contacts. Thus the contacts when broken in a vacuum do not give long life.

A synchronous switch for rendering more satisfactory the oscillographic study of transients was the subject of a paper by H. M. Turner. This switch makes possible both visual and photographic observations of transients and enables a given transient to be repeated as many times as desired and to be shown in the identical position relative to space and time for each repetition. Typical oscillograms illustrating the device were exhibited.

EFFECT OF ALTITUDE ON RATING

The influence of radiation, convection and altitude on the temperature rise of stationary electrical machinery was discussed in a paper by V. M. Montsinger and W. H. Cooney. The division of losses by radiation and convection from tall vertical planes was determined, and then the division of losses from black planes, and based upon this division a simple formula was developed for determining the ratio of losses for an irregular surface for the greater part of the losses by convection. The effect of various colors on the temperature rise of transformers and corrugated tanks was discussed.

The temperature rise and rating of two main classes of oil-immersed, self-cooled transformers as effected by altitude are as follows:

	Per Cent Increase in Copper Rise per 1,000 Meters Increase in Altitude	Per Cent Decrease in Kva. per 1,000 Meters Increase in Altitude
Self-cooled transformers		
(a) With plain tanks	1.75	1.35
(b) With corrugated, tubular and radiator tanks	3.00	2.30

The effect of altitude in increasing the temperature rise of electrical apparatus was discussed in an admirable paper presented jointly by R. E. Doherty and E. S. Carter. Part of the investigation reported consisted in making tests of electrically heated plates inclosed in a large wooden tank or drum in which the air pressure could be controlled. This gave data from which general equations, giving the increase in temperature rise occasioned by lower air pressure, were built up. For studying altitude effect on actual rotating apparatus a 7½-kva. synchronous motor was tested in the drum at various air pressures. An opportunity was thus afforded to check calculations against actual data on rotating machines.

The two papers on temperature rise brought forth an extended discussion, particularly as regards standard ratings of apparatus in which altitude must be considered. Mr. Montsinger pointed out that the per cent increase in temperature rise per 1,000 meters, as given in the A. I. E. E. standard specifications, is greater than is actually the case. For 1,000 meters the specifications give 4 per cent increase in temperature for stationary appartatus, while reliable formulas now in general use give 1.75 per cent and 3.0 per cent for oil-immersed, self-cooled transformers with plain and with corrugated, tubular and radiator tanks respectively.

W. J. Foster of the General Electric Company showed that temperature-rise comparisons between test results on apparatus could not be made with any degree of accuracy as air-current condition varied widely with every test. From this it follows that formulas based on test results are not reliable.

Based on the two papers presented, E. B. Paxton, also with the General Electric Company, entered a proposal for A. I. E. E. standard altitude correction. He pointed out that the present standards are indefinite in that a machine tested anywhere under 1,000 meters is considered suitable for operations anywhere under 1,000 meters, which may lead to a difference in temperature rise of about 6 deg. Also, it is stated that all machines for operation above 1,000 meters shall be regarded as special. In part the new rule proposes that apparatus shall be suitable for carrying their rated load, provided the ambient temperature does not exceed 40 deg. less 2 deg. for each 1,000 meters by which the altitude exceeds sea level. The proposed rule makes the correction definite over all altitudes including those less than 1,000 meters.

Mr. Craighead deemed it advisable to have the utmost simplicity in the rules. As regards the effect of humidity on temperature rise, Mr. Montsinger said that this effect was very small and need not be considered.

New and Proposed Standards

ON WEDNESDAY evening the subject of standards was presented. Chairman H. S. Osborne, who presided, described the present work of the standards committee and called upon the chairmen of the working committees for reports. The work of revision of standards of the Institute has gone far, and several of the accepted and proposed standards were presented in printed form for discussion. Standards for industrial control apparatus have been adopted, and proposed standards on synchronous converters, electric arc-welding apparatus, insulators, fractional horsepower motors and for transformers, induction regulators and reactors are ready for action. P. M. Lincoln announced that proposed standards for induction motors would be available in printed form in the near future.

One of the features of the meeting was an address by chairman A. W. Whitney of the American Engineering Standards Committee. He dwelt up on the broad philosophy of standardization and its place in modern civilization. In his opinion, just as the common law grew up as a standard through the years so should there arise in the in-

dustrial world a body of standards which will codify the best opinions on relations between industries and on the relations of industries to the public. Business and industry must increasingly feel their obligation to think of their activities as affecting social relations, he said, and broad standards should be produced so that progress can be made.

Several constructive and specific suggestions were made by members to the several standards committees. R. E. Argersinger accented the rating of insulators on flashover voltage rather than line voltage. E. P. Peck stated that either frequency or a standard circuit should be specified for all insulator tests. C. W. Bates made suggestions for changing the transformer standards to apply more fully the distinctons between constant-potential and constant-current transformers.

Metropolitan Distribution Systems

ALTERNATING-CURRENT network systems were the principal subjects considered in the technical session on Thursday morning, held under the auspices of the transmission and distribution committee. This discussion was based in the main on the papers of Mr. Kehoe and Mr. Bullard.

A light and power polyphase net work on a single set of mains was placed in service in New York City with 300 kw. installed transformer capacity feeding from five locations and having fifteen elevator motors, as well as a typical city load of apartment lighting, appliances and miscellaneous motors, by the United Electric Light & Power Company. This system and the various elements that went to make it up were described in a paper by A. H. Kehoe. The calculated maximum lighting voltage variation at the services on this installation was 3 per cent. Experience of four months' operation is that such a system will give illumination without flicker at a lower cost and that its services will be of the so-called universal type in that lamps, appliances or motors can be connected to any of them.

The three elements entering into an underground alternating-current distribution system are cables, distribution transformers and protective devices. Tests were made on cables which indicated that if an arcing fault developed between copper and sheath on a 60-cycle single-conductor cable of less than 220 volts, the fault would burn itself off. On a similar high-voltage cable the fault will continue if the restoring voltage on rupturing the arc is in excess of 1,000 volts between conductor and sheath, provided that the fault current is at least 500 amp. At 2,000 volts fault currents as low as 100 amp. will continue to arc. It is thus possible to use a network or grid of low-voltage cables which will rid itself of arcing faults. High-voltage cables, however, must be equipped with protecting devices to eliminate faults on them.

Experience with this design of underground alternating-current low-voltage network fed from several different sources indicates that its reliability will be the same as the reliability of the sources supplying the various radial high-voltage feeders.

Distribution systems in Chicago are in a transient stage, and much study and a long sight ahead is necessary for their development, in the opinion of G. M. Armbrust and J. B. Jackson, who presented a paper on the general light and power supply of Chicago. Energy is distributed in Chicago by 4,000-volt, three-phase, 60-cycle circuits for units of load up to 300 kva. or 400 kva. over all of the area of the city except the downtown portion, which is supplied by the low-tension direct-current networks. Large single loads are supplied to individual transformer installations directly from the 12,000-volt, 60-cycle system. The direct-current system at present covers 8 square miles and distributes about 150,000 kw. maximum. About 5 square miles of the outer area of this system is being transferred to the alternating-current system for better distribution economy. Of the total present direct-current load about 75,000 kw. is concentrated in about one square mile in the downtown loop district. The demand for these various classes of buildings with their diversity indicates a possible load of 200,000 kw. in this square mile in the next twenty years. If the system were being laid out new, the most economical supply would be from eight or ten substations of 25,000 kw. capacity, each distributing over a radius of two blocks.

The 60-cycle, 4,000-volt general light and power supply covers an area of about 150 square miles and supplies 330,000 kva. over about 375 circuits of 1,000 kva. capacity each. These circuits are operated radially, but are provided with emergency switching centers for the transfer of loads between circuits. Feeders are practically all underground and primary and secondary distribution is principally overhead from twenty-two attendant substations of 10,000 kva. to 20,000 kva. capacity and nineteen remote control substations of 3,000 kva. to 6,000 kva. capacity. The rate of increase of load supplied by this system is about 18 per cent per year.

The density of a very large part of the area served from the system is about 4,000 kva. per square mile. Calculations show that for this density the economical size of substation is 7,000 kva. spaced about 1.3 miles and the economical size of feeder is 350,000 circ.mils. As the density increases the economy of the 4,000-volt intermediate system between the 12,000-volt transmission and the secondary distribution voltage becomes less.

Industrial power loads of 4,000 kva. or more are supplied at 12,000 volts from lines subsidiary to the 12,000-volt transmission system. These lines where possible are arranged in loops, usually of 4,000-kva. capacity from attendant substations. There are 125 such installations with an average maximum load of between 500 kva. and 600 kva.

To determine a basis of procedure when it was recently found necessary to rehabilitate completely a large underground low-voltage distribution system serving the business district of New Orleans, a study was made of present systems and new developments in underground distribution. The results of the study were presented in a paper by W. R. Bullard. It was decided to use direct transmission of energy from generating station to distribution transformers at 13,200 volts and to eliminate any distribution substations. The voltage of each feeder is controlled by separate automatic induction regulators in the generating station, and only one transformation is used. For the low-tension side an interconnected network of alternating-current low-voltage mains served by a multiplicity of distribution transformers and by a number of 13,200-volt feeders are employed.. All protective devices external to the generating station are eliminated excepting a reverse-energy - opening, automatic - reclosing network switch, one unit being installed in the secondary leads of each distribution transformer bank.

One system of secondary mains was contemplated for use with both lighting and power service. This combination is effected by the selection of a three-phase, four-wire, Y-connected low-voltage system with 115-volt service between each line leg and neutral, giving 200 volts as the delta voltage.

A method for calculating the steady-state value of short-circuit current in a fault to the ground on a three-phase grounded neutral system was presented by Roy A. Shetzline. The method involves taking account of the symmetry with respect to the faulty phase presented by a normally balanced three-phase system and by making use of a fictitious generator in the fault in place of all sources of emf. in the power network and thus simplifying the calculation and replacing the three-phase network with a single-phase two-wire network that takes account of all loads. The method is developed in detail, and it enables calculations to be made on a single-phase, two-wire basis of short-circuit current on single-phase ground, as regards both magnitude and distribution, and takes into account all system loads.

For the past five years the electric light and power properties under the control of the American Gas & Electric Company have been following a system of standardized construction in the distribution and substation divisions. This system was described in a paper by M. L. Sindeband. By compromise methods and by weighing the opinions of men in different parts of the country a set of standards has been developed which works out very well. To the possibilities and limitations of standardization in overhead distribution work there is no logical limit—no point is indicated where standardization should cease.

General experience shows that standardization results in a better type of construction and in the probability of more reliable service. It produces definite economies in construction and engineering, but requires judgment to preclude the possibility of misapplication. The idea can be carried further —into maintenance and operation—with equally beneficial results.

E. R. Thomas referred to the magnitude of voltage dips which can be detected from lamp illumination by the

eye, investigations of Kennelly and Ives being particularly mentioned. Motion pictures and oscillograms were presented by A. B. Stewart showing the effect of short circuits in lead-sheathed cable.

Referring to the universal distribution system, in which light and power equipment are served from the same system, F. C. Hanker pointed out that a voltage which will be proper for lighting equipment will not give the proper voltage for motors. For example, with a lighting voltage of 115 volts, the motor voltage would be 198, and with 120 volts for lighting the motor voltage would be 208. With single-phase circuits connected from such a system providing both light and power service, it would be necessary to go to 120 volts or 125 volts for the lighting equipment to get the proper motor voltage.

The relative current demand of motors at 220 volts and 208 volts was touched on by A. Harry Sweetnam, who pointed out that the power factor is increased with decreased voltage but the efficiency is reduced.

The total investment in distribution systems is more than that in generating stations and substations, H. R. Smith asserted; thus a greater opportunity is offered engineers for developing new economies in distribution work. With the adoption of the alternating-current network system some changes may be needed in contactors and control equipment for customers' equipment. Voltages should be adopted, he warned, which will enable the use of standard squirrel-cage motors and control. The network switch which is available for use with this system is made in 250, 500, 800 and 1,200-amp. sizes. An alternative solution of the network system described by Kehoe and Bullard is afforded in the Seattle installations, Mr. Smith said.

H. A. Stanley pointed out that regulators will be required more extensively with the universal alternating-current network and that complications may arise in establishing rates for such networks because the same investment is involved for both light and power service. He, too, expressed the belief that there would be more difficulty with this system in maintaining uniform voltage on the secondary system and that the network lends itself to theft of energy.

The increasing difficulties of distributing power in congested districts were emphasized by W. L. Abbott, who pointed out that load densities of 75,000 kw. per square mile exist in Chicago and may increase to 200,000 kw. per square mile in twenty years. Substations are not desirable tenants in congested districts and space for them is scarce. Furthermore, there is the problem of distributing the power through the streets, some of the streets in Chicago's "Loop" being filled with various utility services from the surface to a depth of ten feet.

Reactor Characteristics

UNDER the auspices of the protective devices committee a very extensive discussion of current-limiting reactors took place in the second technical session on Thursday. In all, five papers were presented giving the characteristics, design, installation and operation of reactors and the theory and application of direct-current iron-core reactors and regulators.

Consideration of the design of air-core current-limiting reactances was given by F. I. Oesterreicher in a paper which dealt very largely with the design elements of the reactances for use in large generating and distribution systems to limit the possible concentration of energy at certain critical points. The general characteristics of the various winding types, certain connections affecting the reactance values, the distribution of current in coils and the efficiency of reactors were discussed and formulas developed to give the stresses due to electromagnetic forces, mechanical forces and electrostatic effects. The problem of mutual induction and the problem of locating reactances to best advantage were also taken up.

The design, installation and operation of current-limiting reactors were discussed by F. H. Kierstead and H. O. Stephens. In design the reactor should have low reactance at low current and high reactance at high current. In installation the reactor should be considered from the standpoint of strength, space requirements, location, ventilation and general arrangement.

The reliability and rating of current-limiting reactors as well as their design features were considered by W. M. Dann. The factors affecting reliability were outlined and historical developments of reactors considered. Recognition was given to both the protective function of the reactor and the practical consideration of dimensions and cost in present design.

A theoretical paper on the characteristics of iron-core static apparatus for both direct current and alternating current was presented by A. Boyajian. The general theory of the apparatus was discussed in detail, followed by a description of their application as frequency multipliers, series current-limiting reactors, feeder-voltage regulators and shunt reactors for power-factor control. The ratio of controlling and controlled kva. was also discussed.

Various applications of the saturated-core reactor were described in a paper by David K. Blake. The saturated-core type of regulator is similar to a transformer, consisting of an iron core and coil, and can be built for voltage as high as is desired. From a general study of the situation the indications are that the saturated-core regulator would probably be cheaper for high voltage than the well-known combination of induction regulator with shunt and series transformers. The saturated-core regulator can go from full buck to full boost in one or two seconds, or two or three times as fast as the tap-changing regulator and five to eleven times as fast as the induction regulator. However, the saturated-core regulator has high losses and costs about 25 per cent to 50 per cent more than the induction regulator.

It can be designed in such a manner that if the normal load reactance is 10 per cent, the reactance of the short circuit will be about 30 per cent, and approximately full reactance will be reached only after 0.08 second to 0.16 second.

In the discussion which followed the presentation of these papers N. L. Pollard of the Public Service Production Company expressed the opinion that the thermal capacity of feeder reactors is very important and that more attention should be given to it. He showed how the cost of reactors runs up very rapidly with increased capacity.

In a discussion on the paper of Messrs. Kierstead and Stephens written by O. R. Schurig of the General Electric Company and presented by R. M. Spurck mechanical stresses occurring in the insulators during short circuits were studied. The original paper showed that the peak stress on the braces is slightly in excess of the peak emf. and occurs in the immediate vicinity of resonance. Mr. Schurig explained a method of predicting roughly whether a reactor is resonant or not and how to estimate the peak stress at resonance. The former depends on the natural frequency while the latter may be calculated by assuming elastic supports and braces. The detailed method was given. A further point to which attention must be called, Mr. Schurig held, is the occurrence of tension stresses in the braces. Altogether the reactors are connected so that the average stress in the braces is compression, resonance (or near resonance) will bring about heavy tension stresses of the order of twice the initial average emf.

W. B. Kirke of the New York Edison Company disapproved of some of the circuit connections suggested in Mr. Oesterreicher's paper where reactors were placed between the generators and the outgoing feeder circuit breakers.

High-Voltage Cables

HIGH-VOLTAGE cables, methods of calculating cable capacitance, means of measuring potential gradient and flux density in irregular fields and a presentation of the street-lighting problem were among the subjects discussed at the technical session Friday morning under the electrophysics and the lighting and illumination committees.

That the foundation for future development of high-voltage impregnated paper cables has been laid by the equipment and organization of American cable-manufacturing plants for accurate quality control through the continual testing of raw and process materials was pointed out in a paper by William A. Del Mar and C. F. Hanson. Although considerable progress has been made in cable construction, the authors said, the present problem is to eliminate completely the occluded air and vapor from the installation. Formerly air fumes were regarded as causes of low dielectric strength, owing to ionization of the air and consequent formation of hot spots. The paper advanced the opinion that a more useful conception of the danger of air films is that they promote internal surface leakage.

Data on the determination of dielectric stresses in three-conductor cables and of the geometric factor affecting the calculation of capacity,

dielectric losses, etc., in such cables were presented by R. W. Atkinson. One of the most important conclusions derived from the data collected on the subject was the fact that the maximum stress in cables with sector conductors may occur at the outer tips of the sector rather than toward the cable center and that this stress may be somewhat greater than that in a cable with round conductors.

A direct method for calculating the capacitance for multi-conductor cables with round conductors was presented by H. B. Dwight. This method uses the exact shape of the round conductors and gives accurate expression for the irregular distribution of electricity on the conductors and for the value of capacitance.

The measurement by an improved method of the potential gradient and flux density of alternators and cables in irregular electrostatic and magnetic fields was discussed in a paper by J. F. H. Douglas and E. W. Kane. The method consists of measuring an electric model of the field to be studied cut out of sheet metal. By the use of a contact-making device with two contacts, held at a fixed distance apart, but movable to any part of the edge of the metal sheet, voltage gradients are measured upon a galvanometer, and from these the flux densities are calculated.

In this country cities ordinarily spend about 75 cents per capita per annum for street lighting, and Preston S. Millar said that this could well be doubled on an average in order to provide adequate illumination to meet modern traffic requirements. Street-lighting systems also suffer from lack of uniformity and style, having been designed at different times by people whose ideas as to requirements differ. The manufacturers of lamp posts, lamps and lamp equipment have influenced the type of street-lighting installation and the style in installations has changed, but no more than is warranted by the developments in the art. Economy dictates for smaller installations, at least the choice of standard lamp posts and equipment. No phase of the street-lighting problem is mooted so generally as is the question of equipment of the lamps.

In discussing the subject of cables D. W. Roper agreed with Mr. Delmar in his statement that as operating voltage increases the quality of the cable must improve, that experience with cables should be more readily available and that other than short-time tests are needed to reach conclusions. In addition, he said that some method of testing quality should be developed in order to establish limits of operation for any particular grade of cable. He also called attention to a practice of some European manufacturers in cable stranding—that of making the outer strands smaller than the inner ones.

Herman Halperin called attention to the fact that tests on 12-kv. and 33-kv. cable are being made in Chicago, results of which will be available shortly. He questioned a statement to the effect that the potential gradient at the conductor surface is not the cause of cable breakdown since a large percentage of failures observed in Chicago have been at the outer tips of sector-shaped conductors. European cables had been successful with more than 15 per cent rosin in the compound, he declared, and had lower power factor than shown by the tests presented in papers at the convention. He asked for a really effective method of detecting the extent of ionization of cables. In New York high-tension tests are being made on cable compounds, E. R. Thomas asserted, by establishing thin films between concentric test tubes and using mercury electrodes. Corona discharge occurred at high voltages in these tests after two hours, and gas was given off by the compound, as indicated by the inflation of a balloon fastened to the top of the test tube. At the same time the compound changed color and took on the appearance of Swiss cheese. After melting the compound and testing for breakdown in the ordinary manner, however, it did not appear that the breakdown voltage had reduced appreciably.

Power-factor curves are chiefly of value, commented A. H. Kehoe, in showing the uniformity of workmanship in cables and are not so important because of the actual values obtained.

W. A. Del Mar said that it is possible to get low dielectric loss in cables without sacrificing life or quality.

The use of prismatic refractors for distributing light in the desired directions was the subject of most of the discussion on street lighting. L. A. S. Wood said that it is gratifying to see that standards of illumination for street lighting have been raised by St. Louis above the general standard of 1916. He expressed the belief that the standards will go even higher and that asymmetric distribution of light will play an important part in future street lighting.

Prof. F. B. Caldwell did not agree that the refractor will play such an important part in "white-way" lighting on business streets as had been contended, although he did express the opinion that a refractor designed so that it would not only throw light up and down the street, but across the street on the building faces, will be considerably more effective than the present diffusing globes.

Electrical Machinery

THE technical session on Friday conducted by the electrical machinery committee considered the flashing characteristics of motors, frequency converters, inert-gas transformers and a new type of squirrel-cage repulsion motor. The inert-gas transformer and the squirrel-cage induction motor brought forth an extremely animated and interesting discussion.

The flashing characteristics of series and compound-wound motors were considered in a paper by Ralph E. Ferris. The author concluded that a compound or series-wound machine can be designed which will give little trouble from flashing, though subjected to the most severe operating conditions, provided certain reasonable physical limits have not been exceeded, such as the number of commutator bars, distance between brush holders and total thickness of mica between holders. Further, a strong field in comparison with the armature should be used, and in addition a high ratio of series turns with respect to the shunt turns should be maintained.

A 35,000-kw. induction frequency converter for tying in very large systems was described in detail in a paper by O. E. Shirley. The rating and mechanical construction of the two units were discussed, the tests made after installation were described, and the theory of the operation of the induction unit was developed.

A transformer with an oil-immersed unit having a space above the oil surface filled with an inert gas composed entirely of nitrogen was described by W. M. Dann and D. R. Kellogg. The body of nitrogen is automatically created and maintained above the oil surface by means of the controlled natural breathing of the transformer through a chemical container which absorbs the twenty-one parts of oxygen and leaves only the seventy-nine parts of nitrogen to pass into the case.

A new type of constant-speed alternating-current motor for application to single-pase systems was described by F. R. Bergman. The motor was derived from the plain repulsion motor, and its novel features consist of having an armature containing a combination of three winding elements, a commutating winding, a squirrel-cage winding of high reactance and a commutating device consisting of shielded strips.

The results of an analytical study of the operation of a squirrel-cage repulsion motor consisting of a repulsion motor which a squirrel cage placed well below the commutated rotor winding were given in a paper by H. R. West.

In a written discussion on the paper by Messrs. Dann and Kellogg describing the "inertaire" transformer, A. H. Maude gave data showing that oil, unless it comes from a sealed can, must be expected to contain oxygen in solution, and precaution must be taken in some way to prevent this oxygen from contaminating and reducing the effectiveness of the inertaire gas cushion as a preventive of explosion and as a preserver of oil.

An instance was described in a paper read for H. L. Hewlett where an ordinary transformer closed for two months contained only 17 per cent oxygen in the air above the oil, showing that a considerable amount had been absorbed by the oil.

The paper presented by Mr. Bergman describing a new type of squirrel-cage repulsion motor brought forth one of the most lively discussions of the entire convention. In a written contribution by Valere A. Fynn, read by P. M. Lincoln, the utter disregard alleged to have been shown by Mr. Bergman of what had previously been done along similar lines and his failure to give any credit whatsoever to previous investigators was severely criticised. Edward Bretch in a written discussion said that his motor was very similar to the one discussed by Mr. Bergman.

In replying to Mr. Fynn's remarks, Mr. Bergman acknowledged that credit was due to Mr. Bretch's pioneer work, but maintained that Mr. Bretch should have carried it on to completion instead of letting it drop.

Management Charts for Central Stations

How a Series of Graphs Effectively Presented Keeps Executives Posted on Utility Output, Extensions and Financial Requirements as Exemplified by the Experience of a Large Middle West Company

By HARRY A. SNOW
Assistant Controller Detroit Edison Company

BY "MANAGEMENT CHARTS" is understood a set of charts presenting facts of fundamental importance in the successful conduct of an electric central-station company. There are, of course, a great many facts collected in a statistical department which have only a limited interest, but there may be selected from the mass of figures certain ones which are fundamental. These figures are key figures, setting forth in summarized form the basic facts of company operation. If presented graphically, they serve the executive staff of the company as the instrument board serves the chief engineer of a power plant. For an electric central-station company served by steam-power plants, such as the Detroit Edison Company, it has been found through a period of years that the following selection of subjects for management charts has been very beneficial:

OUTPUT GROUP:

1. System load curve.
2. Power-plant output in kilowatt-hours.
3. Plant capacity and maximum load.

EXPENSE GROUP:

4. Analysis of expense.
5. Unit operating expense.
6. Cost of coal.
7. Plant efficiency.
8. Coal stock on hand.
9. Number of employees and wage level.
10. Amount set aside for retirement expense.

EARNINGS GROUP:

11. Analysis of earnings.
12. New business added.
13. Ratio of expenses to earnings.
14. Net earnings and dividend requirements.

FINANCIAL GROUP:

15. Cash required for new construction.
16. Loans and interest rate.
17. Outstanding stock and bonds.
18. Number and location of stockholders.
19. Market price of stock.

BUSINESS CONDITIONS GROUP:

20. Building permits.
21. Construction material prices.
22. Prosperity index.
23. Employment conditions.
24. Power sales.

The above facts lend themselves very readily to graphic presentation, which is most effective if use is made of a display rack (see illustration on page 13) having eight or ten removable leaves so placed as to be conveniently accessible to those interested. The individual charts for the Detroit system, attached to the leaves of the display rack by thumb tacks, are sufficiently large to rank as poster or display charts with proper use of colored inks and with adequate titles in clean-cut black lettering. A convenient size for the majority of the charts is 17 in. x 11 in., and the graph paper used is of extra good quality. Bare places on the display racks are filled in with photographs of power plants, substations, tower lines and maps of the transmission system and of the territory served.

USES OF MANAGEMENT CHARTS

Some one of these twenty-four charts is sure to behave queerly if anything goes seriously wrong with a public utility enterprise. Conversely, if all of the curves look well, it is reasonably certain that the company is in healthy condition. Taken together, the graphs give a comprehensive picture of present conditions. They also have the additional great advantage, inherent in graphic presentation, of permitting a quick and accurate comparison of present conditions with previous conditions at any selected time or over the entire period of recent experience. The display rack of charts is not only useful in analyzing, studying and comparing present conditions with past experience, but it facilitates that very important part of executive work, the formulation of reasonable estimates for future performances. This estimation of future performances is intimately connected with budget work. Still another advantage of the display rack is that it presents a comprehensive review of all phases of company activity. Being prominently placed, it assists in broadening the interest of department heads who might have a tendency to become narrowly departmentalized in their knowledge.

The cost of maintaining such a set of charts is not large. The necessary figures are commonly kept in any statistical department and in most accounting departments. It is essential that points be posted promptly in order to maintain interest. This requires that some one clerk hold it an important part of his daily duties to collect and post the new data promptly. Perhaps an average of an hour a day will suffice for this routine posting. New points are ordinarily entered in pencil, to be inked in later when a number of points have accumulated.

THE OUTPUT GROUP

Perhaps the commonest curve in central-station practice is the daily system load curve (Fig. 1) illustrating the variations of power-plant load from hour to hour throughout the day. Kilowatts of power-house load are plotted vertically, and the time of day in half-hourly steps is plotted along the base line on specially printed graph paper with vertical lines each half hour. The curve runs from one midnight to the next midnight and is plotted, blueprinted and distributed by noon the following day. Actual figures for peak load, plant output in kilowatt-hours, average load and daily load factor are typewritten at the bottom of the curve sheet.

Variations of plant output from week to week are shown by averaging each week the output for the

preceding four weeks and plotting the result. Fig. 2 is a chart covering six years. With a point each week, this will be about 15 in. wide. A very useful reference line by which to judge the growth of output may be calculated by averaging the figures for several normal years to obtain an average year, calculating and eliminating the actual growth from year to year and substituting an assumed standard rate of growth such as 10 per cent a year, or 10,000 kw. a year or any other satisfactory figure. The resulting curve has correct seasonal shape and rises across the sheet at a set rate of growth. Actual figures plotted against the standard so set will vary therefrom. If the deviations (in per cent) are plotted below, the deviation curve will illustrate variations of the rate of growth in output from a predetermined standard, and hence will show business conditions.

The third and last curve of the output set (Fig. 3) shows plant capacity, and plotted against it the thirty-minute maximum demand on the system. Points may be plotted monthly, the capacity rising in the vertical leaps of a black curve and the output following on an ordinary broken-line curve. The area between the two lines represents reserve plant capacity. If the lower line approaches the upper line (it may sometimes cross it for brief intervals), trouble is probably ahead for the plant operating force.

THE EXPENSE GROUP

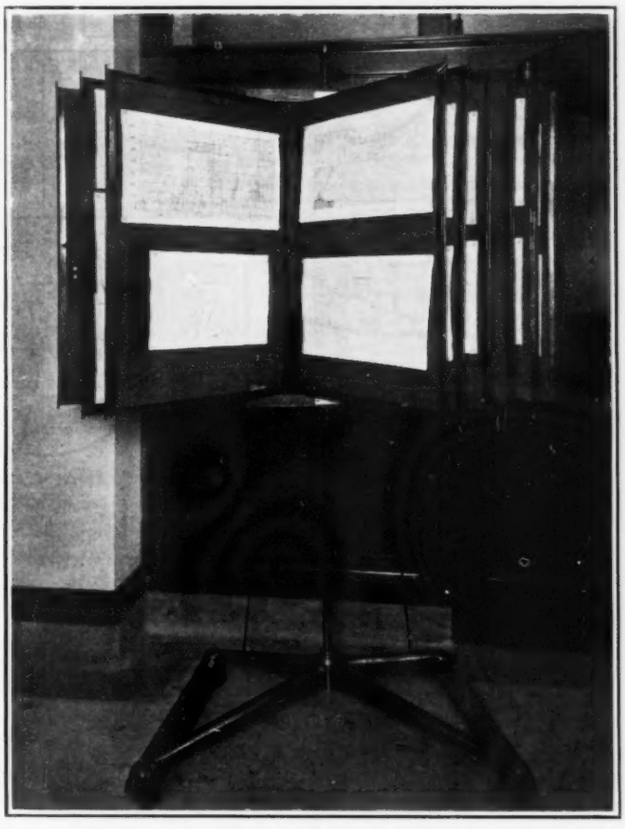
The next group of curves has to do with the expenses incurred in operating the company and with one or two allied subjects. The first curve (Fig. 4) shows total operating expense, excluding the appropriations to retirement reserve, divided by the number of kilowatt-hours sold, giving the unit operating expense per kilowatt-hour. This expense is further divided into two general divisions, coal expense and all other expenses (Fig. 5). During the recent spectacular changes in the price of coal this division has been very useful.

Because of the importance of coal costs to a company operating steam-power plants, this division of operating expenses has been supplemented by three additional curves that are not exactly expense curves, but which do explain the reasons for wide variations in coal expense. The first of these curves shows the average cost of coal per ton as delivered at the power plants (Fig. 6). Two costs are plotted—one the cost of coal actually purchased during the month in question, and the other curve the average cost of this recently acquired coal and of the coal already in the stock piles. In 1920 and again after the miners' strike of 1922 the fluctuations of these curves were of absorbing interest because of the very high current coal prices.

The next supplementary curve (Fig. 7) sets forth the number of pounds of coal consumed by the power plants per kilowatt-hour of plant output. This curve varies partly with plant efficiency and partly with the quality of coal purchased. Most companies are making regular strides in reducing the consumption of coal for a given plant output. But progress along this line was seriously interfered with by the conditions of overload and inadequate maintenance existing during war times.

The last of the group of curves (Fig. 8) dealing with coal expense is the curve representing the number of tons of coal on hand in the stock piles. Normally several weeks' supply is carried as reserve against interruption of the regular shipments of coal from the mines. At times when difficulty in obtaining the regular supply of coal may be expected, or at times when market prices of spot coal are exceptionally favorable, this supply of reserve coal may be very much increased, and of course transportation tie-ups and strikes force central stations to cut into their reserves. All coal consumers were living from hand to mouth during the shortages of 1919 and 1920, and stock piles were in some cases non-existent. It is helpful to plot on the same sheet and to the same scale as the supply of coal on hand the monthly consumption of coal, so that a glance will show roughly how long the reserve supply would last if not supplemented by daily shipments.

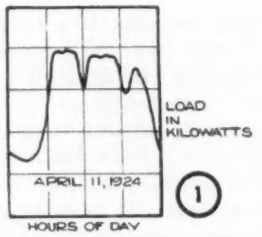
Labor costs are another important item of expense. These are graphically illustrated for the Detroit Edison Company by two curves—one showing the number of



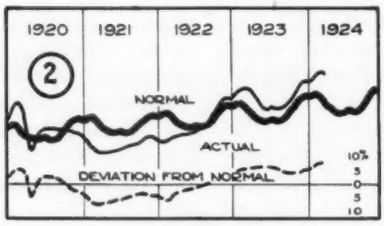
USING REMOVABLE DISPLAY RACKS FOR EASE IN POSTING NEW DATA, THESE MANAGEMENT CHARTS ARE KEPT RIGHT UP TO THE MINUTE FOR THE OPERATING STAFF OF THE DETROIT EDISON COMPANY

operating employees and the other the average wage level (Fig. 9). Wages may be evaluated somewhat more accurately if some one of the recognized cost-of-living indices is plotted in conjunction with them, the ratio of the two curves giving the actual wages in commodities instead of in dollars.

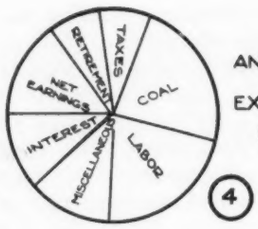
Retirement expense is one of the largest elements of expense. Since charges to operating expense for retirement reserve account are somewhat arbitrary, being determined by theory or by necessity rather than by actual expenditures, it is well to present exactly the amounts set aside for this purpose (Fig. 11). The adequacy of the charges may be roughly illustrated by calculating and plotting on the same sheet the ratio of retirement expense to fixed capital and to gross earnings.



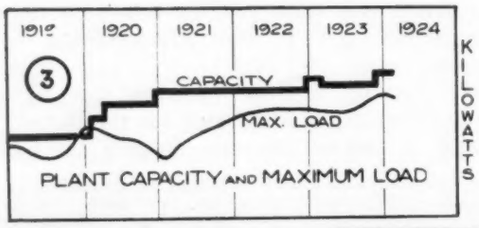
SYSTEM LOAD CURVE



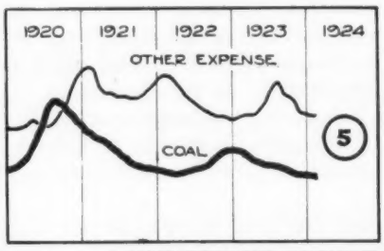
SYSTEM OUTPUT KWH



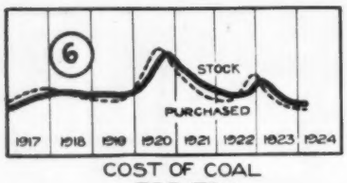
ANALYSIS OF EXPENSE 1923



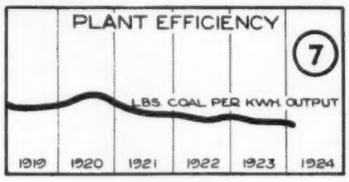
PLANT CAPACITY AND MAXIMUM LOAD

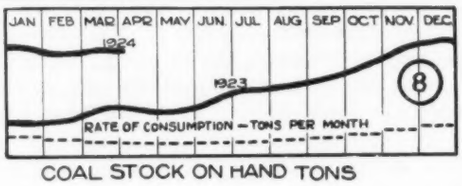


UNIT OPERATING EXPENSE

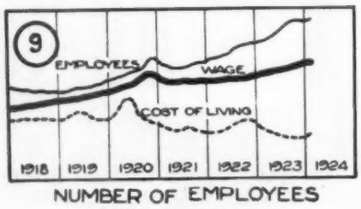


COST OF COAL PER TON

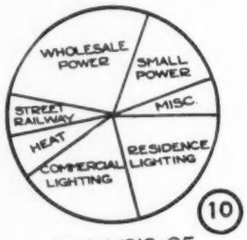




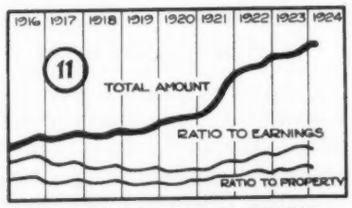
COAL STOCK ON HAND TONS



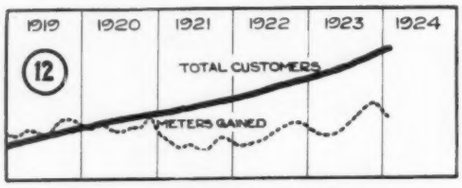
NUMBER OF EMPLOYEES AND WAGE LEVEL



ANALYSIS OF EARNINGS 1923

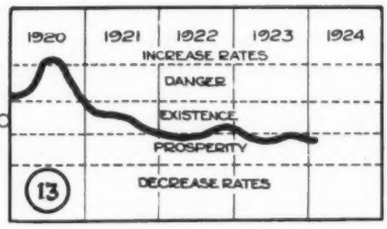


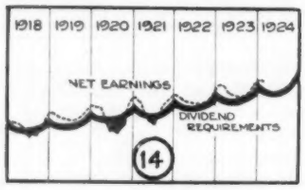
AMOUNT SETASIDE EXPENSE FOR RETIREMENT



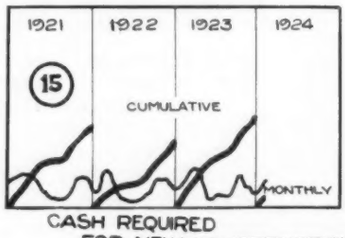
NEW BUSINESS ADDED

RATIO OF EXPENSES TO EARNINGS

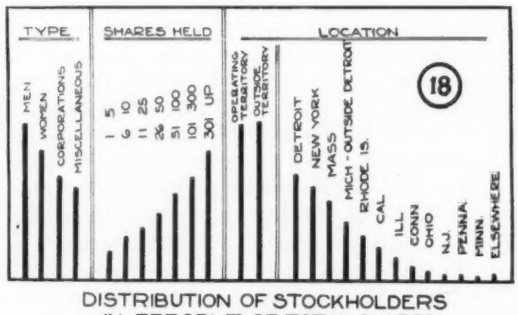




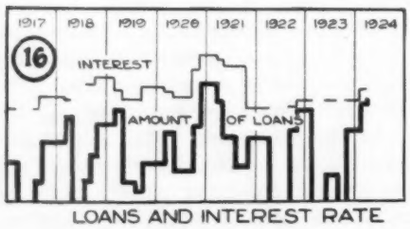
NET EARNINGS



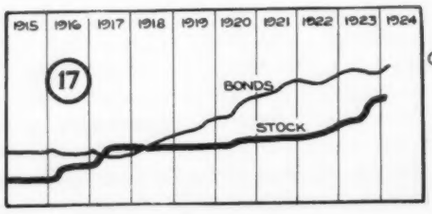
CASH REQUIRED FOR NEW CONSTRUCTION



DISTRIBUTION OF STOCKHOLDERS IN PERCENT OF TOTAL SHARES OUTSTANDING



LOANS AND INTEREST RATE

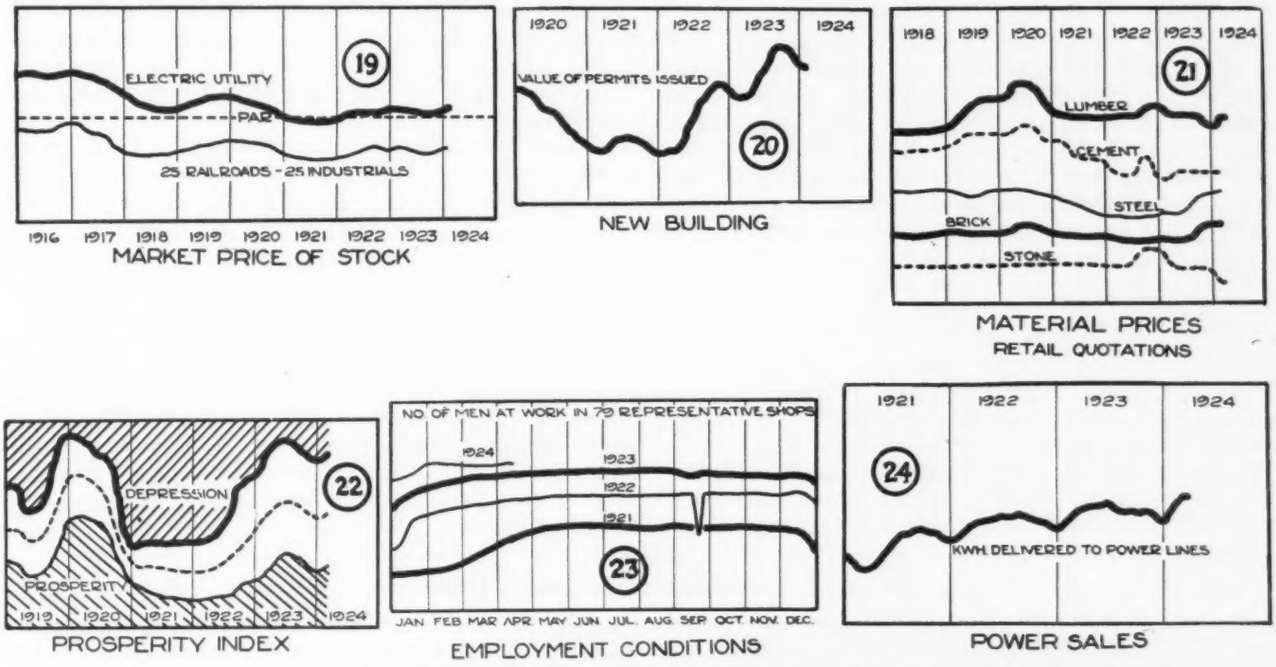


OUTSTANDING STOCK AND BONDS

BUSINESS BAROMETERS FOR THE MANAGEMENT TO READ

Following the expense group of curves comes the earnings group, indicating the source from which income arises and their relative strength or weakness. The first graph (Fig. 10) is the ordinary sectored "pie" split into portions proportional to the number of dollars realized from each of the several sources of revenue. The second curve of the earnings group (Fig. 12) deals with a supplemental subject—the number of customers connected to the system. The total number of customers gives a curve gradually rising as it crosses the sheet, and the gain in customers each month in comparison with the previous month gives an irregular broken curve which must be plotted to a scale different from that used for the total number of customers.

The "operating ratio" is defined as the ratio of expenses to earnings, expenses for this calculation being assumed to exclude retirement expense and interest and dividends. It is, in less technical phraseology, the number of cents out of each dollar earned which must be paid out for operating and maintenance expenses before capital charges can be provided for. It is a fairly accurate index of the financial health of a company. But because it has a distinctive seasonal variation, being inherently high in the summer and low in the winter, it must be corrected before the financial position as shown by a single month's ratio can be accurately judged. The "operating ratio" (Fig. 13) before correction is plotted in some inconspicuous color like orange, and the "operating ratio" after correction for seasonal variation may be superimposed in heavy black. A feature may be added by dividing the upper part of the graph paper into five horizontal zones by lines parallel to the base line. The upper zone, in which the "operating ratio" will lie when expenses are nearly as large as earnings, may be labeled "rate increases imperative." The other four zones may then be labeled in order "danger," "existence," "prosperity," and lastly, "rate reduction imperative." The "operating ratio" plot will fall in the last or lowest zone only when earnings are very much larger than all the expenses. Since earnings are high in the winter months when days are short, requiring much lighting, and since days are correspondingly long in the summer time, a curve of net earnings would show regular rises and falls from season to season (Fig. 14). To judge the adequacy of current net earnings to meeting dividend requirements for the year, the amount necessary to pay the regular dividend on the outstanding capital stock may be computed and divided among the various months in proportion to the net earnings usually realized to obtain a "dividend requirements" curve which rises and falls seasonally with the net earnings curve. If the net earnings curve is above the dividend requirements curve, the area between the two curves represents surplus and may be shaded with yellow crayon. If the net earnings curve lies below the dividends requirements curve, surplus must be drawn upon to pay dividends and the area may be blocked out in black. So if the net earnings curve drops below the base line, the company is not earning its bond interest and is in a very bad way.



FIGS. 1-24—WITH THESE CHARTS THE MANAGEMENT CAN READILY DETERMINE AT A GLANCE THE ACTUAL OPERATING CONDITIONS OF A CENTRAL STATION AS WELL AS THE FINANCIAL AND BUILDING STATUS NECESSARY TO TAKE CARE OF FUTURE EXPANSIONS

THE FINANCIAL GROUP

After consideration of output, expenses and earnings comes the problem of getting fresh capital to extend and enlarge the plant and also to give service to new customers. Because of the very rapid growth in the use of electricity, fresh supplies of money must be continually obtained to finance construction work. The "cash requirements" curve (Fig. 15) illustrates this problem. Each month there is plotted in orange the amount of fresh capital put into the business and a cumulative curve in black shows the rising total for the year. The cumulative curve is started at zero each January. If advance estimates of cash resources and requirements as determined from the budget are plotted in pencil, the degree of correspondence existing between the black curve and the pencil curve gives a graphic picture of the accuracy of budgeting.

Current cash requirements may be met by short-term loans at the banks until totals become sufficiently large to warrant permanent financing. The second financial curve (Fig. 16) gives the fluctuating totals of short-term loans and the average interest rate on such outstanding loans. The interest rate on time loans is a valuable index to the state of the money market. In the last ten years it has fluctuated between the wide limits of 4 and 8 per cent. Outstanding bonds and outstanding capital stock curves make up the third of the financial charts (Fig. 17). The outstanding amounts of these two classes of securities should maintain a reasonably fixed ratio to each other. During the war and the post-war depression of 1920 financing had largely to be done by the sale of mortgage bonds. Lately it has been possible to market junior securities to bring the two classes of securities into proper balance.

A different type of chart, the column chart, is used to depict the number and location of stockholders and the size of their holdings (Fig. 18). The sale of stock in small lots to customers has greatly increased the number of public utility stockholders. The study of the number of stockholders, the average number of shares per stockholder and the number of shares held by employees and customers has been of increasing interest.

The last of the set of curves (Fig. 19) dealing with financial conditions show the market price of the common and preferred stock of the company and, for purposes of comparison, the average price of fifty stocks as selected and priced by the New York *Times Annalist*. Under normal conditions the price of a seasoned public utility stock with a good dividend record will vary inversely with the current interest rate on time loans and will follow market averages closely.

The last group of graphs relates to the environment in which the utility operates rather than to the operations of the utility itself. There are five such curves covering new building permits, prices for construction materials, general business prosperity, employment and the volume of manufacturing as shown by power consumption. The volume of new building (Fig. 20) is reported by the municipal department of buildings. The data are erratic and use is made of a six months' traveling average to eliminate peaks and valleys and to indicate trends. Monthly figures are also plotted, but they are in inconspicuous orange, to fade into the background. Prices of brick, cement, crushed stone, structural steel and lumber are obtained monthly by the purchasing department and plotted in colors, but no attempt is made to weigh them and combine them into a cost-of-building index (Fig. 21).

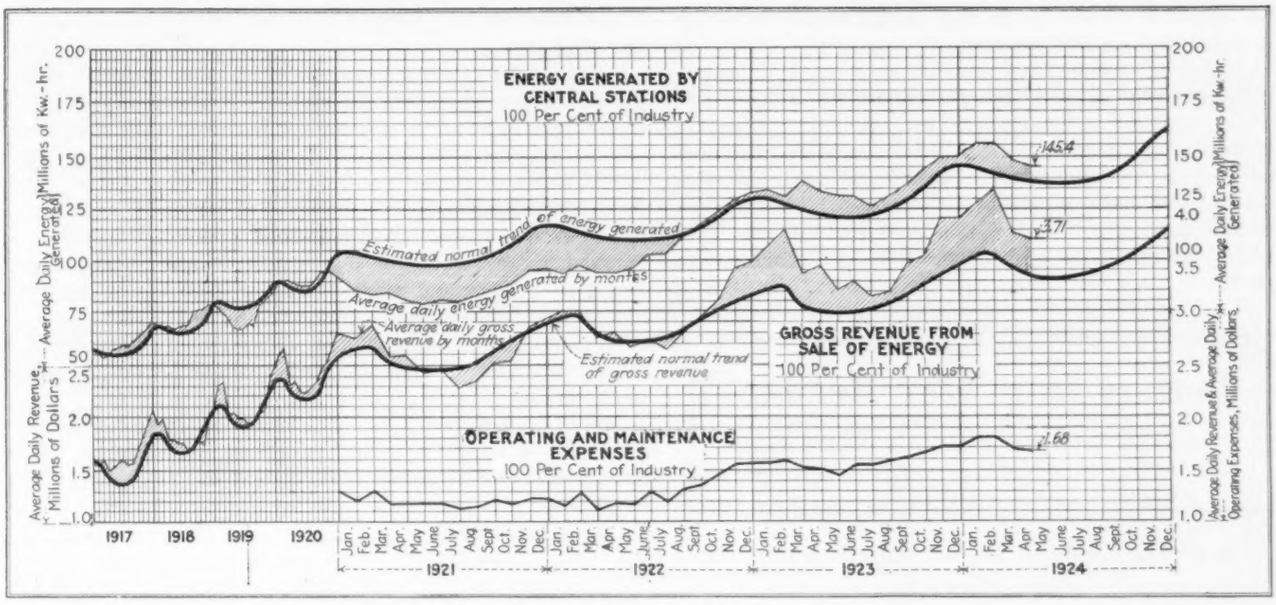
The trend of opinion as to present relative prosperity or depression (Fig. 22) is reported by the statistical bureau of one of the large banks and is based upon replies to a circular letter sent to a large number of business men. The Employers' Association reports weekly, as an index of employment conditions, the number of men on the payrolls of the leading factories who are engaged in productive labor, office employees being excluded (Fig. 23).

A very remarkable similarity exists between the curve of factory employees at work productively described above and the curve of sales of current for power (Fig. 24). It happens in the case described that power service is very largely given from special three-phase distributing circuits which do not serve any considerable number of lighting customers. Midnight readings on the integrating watt-hour meters on these power lines are telephoned in by substation operators, and by noon of the following day a point is posted indicating very accurately business activity for the preceding day. During the slump of 1920 and 1921 sales of energy for power purposes dropped to one-third of their previous level, while lighting sales, in particular to residence customers, were almost unaffected.

Winter Troubles of a Small Plant

ABOUT 8 miles of the transmission line from this small hydro-electric plant of the Eastern Oregon Light & Power Company in the mountains of Oregon runs through timber land in which the right-of-way has not been cleared. This winter the pipe line, which is to the right of the transmission line looking up the hill from the plant, sprang a leak, and the spray blown by a high wind piled up glare ice on the poles and surrounding landscape for 150 ft. around. Two spans of a branch transmission line and the telephone line were broken down by the weight of the ice. It took four days in zero weather to mend the leak.

Material Decrease in Industrial Power Requirements


ENERGY GENERATED BY CENTRAL STATIONS
100 Per Cent of Industry
Estimated normal trend of energy generated
Average daily energy generated by months
GROSS REVENUE FROM SALE OF ENERGY
100 Per Cent of Industry
Average daily gross revenue by months
Estimated normal trend of gross revenue
OPERATING AND MAINTENANCE EXPENSES
100 Per Cent of Industry
1454
371
168
Average Daily Energy Generated, Millions of Kw.-hr.
Average Daily Revenue, Millions of Dollars
Average Daily Revenue & Average Daily Operating Expenses, Millions of Dollars
1917 1918 1919 1920 1921 1922 1923 1924

THE extent of the curtailment in general industrial activities during the first four months of the year is clearly indicated by reports of central-station operation which are received monthly by the ELECTRICAL WORLD from companies representing approximately 75 per cent of the installed generator rating of the country. April, data on which are just available, shows a continuance in the decrease in the energy requirements by industrial plants. During the first four months of the present year the amount of energy required by industrial power customers in the country as a whole decreased by approximately 7.5 per cent. In the industrial sections, however, the decrease in industrial power requirements was even greater.

The central stations of the country generated a total of 4,362,541,000 kw.-hr. in April, or a daily average of 145,400,000 kw.-hr. This is a gain of 6.6 per cent over April of last year. A study of the accompanying

TABLE III — OPERATIONS OF CENTRAL STATION HYDRO AND FUEL POWER PLANTS IN THE UNITED STATES
(100 per Cent of the Industry)

Month	Energy Generated				Fuel Consumption		
	Hydro Plants		Fuel Power Plants				
	Thousands of Kw.-Hr.	Per Cent	Thousands of Kw.-Hr.	Per Cent	Coal (Short Tons)	Oil (Barrels)	Gas (Thousands of Cubic Feet)
1924							
*March	1,701,322	37.0	2,891,257	63.0	2,785,416	1,494,586	3,098,841
April	1,811,655	41.6	2,550,886	58.4	2,515,689	1,161,915	2,744,775

TABLE I—GENERATION AND DISTRIBUTION OF CENTRAL-STATION ENERGY IN THE UNITED STATES
(100 per Cent of the Industry)

Mos.	Kw.-Hr. Generated Monthly			Distribution of Energy Generated										Kw.-Hr. Purchased for Resale	
				Total Energy Consumption by Central-Station Customers, Kw.-Hr.		Energy Consumed for Lighting Kw.-Hr.		Energy Consumed for Power Kw.-Hr.		Energy Sold to Electric Railways Kw.-Hr.		Energy Used in Intra-Company Business Including Line Losses, Kw.-Hr.			
	1924 Thousands	1923 Thousands	Per Cent Inc.	1924 Thousands	1923 Thousands	1924 Thousands	1923 Thousands	1924 Thousands	1923 Thousands	1924 Thousands	1923 Thousands	1924 Thousands	1923 Thousands	1924 Thousands	1923 Thousands
February	4,465,858	3,966,278	12.2	3,604,858	3,201,278	733,000	635,000	2,381,858	2,122,278	490,000	444,000	861,000	765,000	750,000	600,000
March	*4,592,579	4,331,204	5.9	3,706,579	3,494,204	788,000	683,000	2,395,879	2,319,704	522,700	491,500	886,000	837,000	786,500	633,000
April	*4,362,541	4,084,611	6.6	3,521,041	3,295,111	749,000	649,500	2,258,041	2,162,611	514,000	483,000	841,500	789,500	734,000	570,000

* Data on "energy generated" are those collected and published by the United States Geological Survey for all public utilities, minus such data as are collected on energy generated by electric railway companies, reclamation service and manufacturing plants. The data are, therefore, for the electric light and power industry only.

TABLE II—CENTRAL-STATION FINANCIAL OPERATIONS FOR THREE MONTHS IN THE UNITED STATES
(100 per Cent of the Industry)

Mos.	Gross Revenue from Sale of Energy†			Operating and Maintenance Expenses‡			Operating Ratio					
							Steam Plants		Hydro Plants		Combined Steam and Hydro Plants	
	1924 Thousands	1923 Thousands	Per Cent Increase	1924 Thousands	1923 Thousands	Per Cent Increase	1924	1923	1924	1923	1924	1923
February	$122,760	$108,500	13.2	$53,303	$46,483	14.8	46.1	46.7	29.6	28.8	43.7	45.3
March	118,010	106,310	11.0	54,050	49,000	10.3	48.6	51.3	28.6	26.5	46.2	44.7
April	111,400	102,500	8.7	50,200	45,050	11.3	49.2	49.8	29.0	28.9	46.8	44.8

† Aggregate gross revenue from actual consumers and sales to other public utilities for resale, involving a certain amount of duplication.
‡ Do not include interest, taxes, depreciation or sinking fund.

diagram indicates that the energy generated by central stations during April was about 5.4 per cent above what it would have been if the energy requirements of the industry had been normal.

A total of 841,500,000 kw.-hr. was used in intercompany business and line losses during April, leaving a total of 3,521,041,000 kw.-hr. sold to actual consumers. Of this amount 21.3 per cent was consumed for lighting, 14.6 per cent by electric railways and 64.1 per cent for industrial power purposes. The returns indicate that a total of 734,000,000 kw.-hr. was sold within the industry for resale purposes during the month.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Why Not Establish More Public Relations Departments?

To the Editors of the ELECTRICAL WORLD:

If we could only see ourselves as others see us! Many public utility officials have expressed this wish since the public relations problem began receiving so much well-deserved attention. Perhaps the experience and observations of a staff member of a regulatory commission would present such a viewpoint. The writer has been engaged for several years in the actual inspection of the service being rendered in the State of Illinois by utilities both large and small, acting as mediator in cases of friction between central-station companies and their consumers, co-operating with utility officials and interviewing public officers and representative consumers. These close personal contacts have given an insight into the public relations problem that might prove of value to others.

Observation of the activities of these companies and interviews with the central-station managers have revealed that all large organizations have found it advisable and necessary to divide their functions so that each may be performed by a department especially provided with talent and equipment to discharge its duties.

What has been done in most companies toward establishing a special department charged with the duty of improving the relations between the company and its public? Has a competent person been placed in charge of this work and intrusted with the duty of serving as a medium of close personal contact with patrons? Are there those who study the public attitude and devise means of improving it? Is there a department that can be called upon on short notice to repair breaches with customers? Is this work administered by one familiar with the psychology of the public? Is some one devising plans for imparting better understanding on these points to employees? If the answers to these questions are in the negative, it is apparent that a special department should be organized whose sole duty would be the handling of matters directly and indirectly concerned with the matter of public relations.

Many operators in this state have agreed that this is the logical step. The scope of the work is so broad that the departmental activities would be many and varied in character. Such a department should actually keep in touch with all departments of the company and be empowered to take matters up directly with the executives, who would thus be kept advised of affairs throughout the organization.

In one sense such a department should represent the public rather than the company. It would approach each question as an intelligent sympathizer with possible complaints supplying such technical information as might serve to dispel the illusion that a wrong is being done, correcting possible errors and tactfully showing the reason for any misunderstood policy or practice. The consumers would be led to see the utility business in its true light and made to realize that its interests and those of the company are one and the same. Once customers learn that this department represents their interests, distrust, suspicion and misunderstanding will begin to disappear.

Many suggestions have been made covering the possible activities of a public relations department. A partial list of departmental endeavors is set forth herewith.

SCOPE OF WORK OF A PUBLIC RELATIONS DEPARTMENT

1. Improvement of public attitude toward company.
2. Providing a customers' bureau organized to take care of their interests in every way and to act as their "champion" in contact with company or when complaints against its service are made, the duty of the bureau being to satisfy, educate and help customers.
3. Intensive campaign to establish better standing of company in any certain district where special conditions prevail.
4. Preparation of papers and reports for the executive officers and associations.
5. Training and supervising employees of the department—field and office.
6. Co-operation with district managers on related matters, such as office appearance, policy and local conditions.
7. Addressing schools, civic meetings and other bodies on associated subjects.
8. Preparation of bulletins and advertising matter for use in campaign.
9. Presiding at district and local office meetings held to inculcate the idea in the organization.
10. Co-operation with the state regulatory body in all phases of complaints and service work.
11. Formulation of plans and systems for interesting employees in the movement.
12. Personal interviews with employees lacking tact or proper point of view.
13. Studying out plans to improve ability of employees in better public relations campaign.
14. Co-ordination of work of various departments as regards furtherance of contact with the public.
15. Comprehensive surveys of employees and of their public contacts with the view of recommending shifts for the good of the service—an organization mutual-betterment movement, not a spy system.
16. Obtaining information as to the public attitude and its reasons, for information of executives.
17. Surveys in the field to determine condition of service and possibilities of improvement; reports to executive officers.
18. Provision of a "clearing house" for all available information bearing upon the department's work.

Limitless ways of improving relations can be devised, but a spirit of unselfish service must prevail throughout the organization if the desired results are to be had. The cost of developing this superservice will be no small item. It is, however, generally conceded that the investment is one which will pay huge dividends.

H. T. EAST,
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Central Station and Industrial Practice

Special Potheads for Power Transformers

By Arthur Palme
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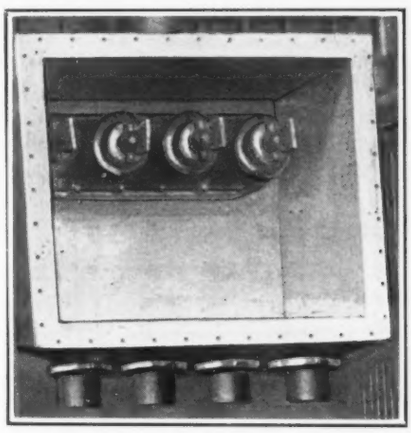
General Electric Company,
Pittsfield, Mass.

IN DENSELY populated metropolitan districts city ordinances force the use of underground cables for power transmitting and distributing systems. The limiting feature for their use is only the operating voltage of the cable, as it is, for the time being, difficult to manufacture lead-sheathed underground cables and their connecting armatures for very high voltages. Recently installations with single-conductor cables for 44 kv. and 66 kv. have been put into successful operation in two large cities.

The two chief advantages of a



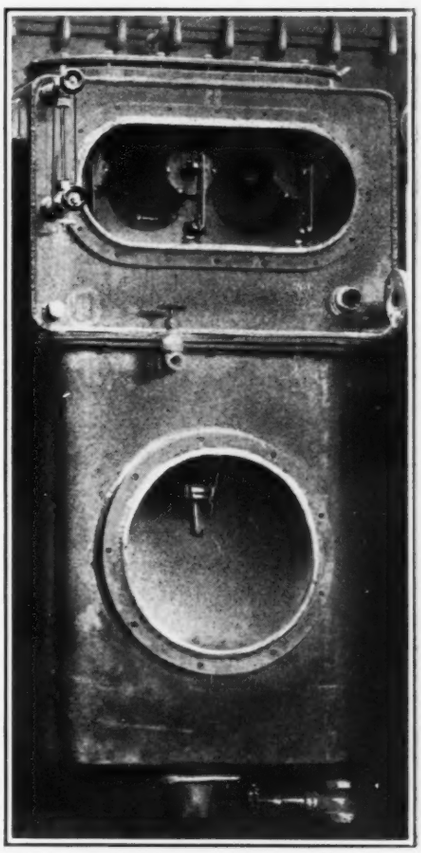
LOW-VOLTAGE SIDE OF POTHEAD TRANSFORMER

cable line—absolute safety to the public and the immunity from lightning disturbances—are both seriously impaired at the beginning and at the end of the trunk line, where it emerges with the cable from the ground and overhead connections to step-up and step-down transformers. In order to obtain the full benefits of such a cable line it would therefore be essential to inclose its ends completely in a metallic box, which would be part of the transformer, so that actually no live parts of the line would be openly exposed to the air.

Thus in addition to establishing a complete transmission system safe against any atmospheric disturbances, the further advantage would be gained that an instalaltion of this nature would represent the utmost safety to the operator, there being no possible chance of his ever coming in contact with any live parts of the transformer. In restricted installations, indoor as well as outdoor, where frequent change-overs, painting, etc., are necessary during which the transformers cannot be "killed," this feature may obviously be of great importance.

Recognizing these points, this company has built recently thirteen power transformers for the Brooklyn Edison Company, which have been installed at various substations, mostly out of doors. These transformers are rated as follows: Three-phase, 60 cycles, self-cooled, 10,000 kva., high voltage 26,400 in delta, low voltage 4,560 in star, with neutral point brought out. Taps are provided in the high-voltage side to give four voltages. In addition, the high-voltage winding is divided into two portions which can be connected in series or multiple. The change from tap to tap can be conveniently accomplished by means of ratio adjusters, the operating handles of which are carried through the cover of the tank. There are neither low-voltage nor high-voltage leads mounted on the cover, and the ends of the transformer winding are connected within the tank to horizontal bushings, piercing the upper part of the tank wall. Four low-voltage and three high-voltage bushings are in this way mounted on the right and the left side of the tank respectively. While the high-voltage leads are brought out through three individual openings, the current through the low-voltage terminals is so high that a steel tank wall would be overheated around each of the bushings. It was therefore necessary to provide for these a narrow opening long enough to accommodate all four bushings in a line and to mount them on a non-magnetic brass-alloy cover plate, closing up the long opening and having itself four individual round openings for the four leads.

These three high-voltage leads and the four low-voltage leads on the opposite side are inclosed in rectangular steel boxes welded permanently to the sides of the tank. The box on the low-voltage side has a flanged edge, so that its entire front cover can be taken off if the necessity for this arises. The bottom of this box contains an alloy casting with four circular openings through which the four single-conductor cables are introduced. A



HIGH-VOLTAGE SIDE OF BROOKLYN COMPANY TRANSFORMER

wiped joint is provided between the lead sheath of each cable and the four special alloy collars surrounding them on the outside, while the sheath is spun out in the inside of the box over a funnel-shaped part of the alloy collar. After completing all joints and connections the cover is bolted to the front of the box, using a cork gasket, and the box is completely filled with a cable compound. To do this conveniently a 6-in. pipe, 2-ft. high, has been

mounted on the top of the box. To drain the compound a 2-in. valve is provided at the bottom.

A similar rectangular steel box, permanently welded to the main tank, completely surrounds the three high-voltage bushings on the other side of the tank. This box is entirely filled with transformer oil, the oil communicating with that of the main tank through a 2-in. pipe, into which is inserted a three-way valve. To expel the air from this chamber while the oil is being filled in, and to be sure that it is always full of oil, the top of this box is connected with a vent line to the upper part of the oil conservator. A boiler type sight gage mounted on the front side of the box should always show a full column of oil. An oval hand-hole with tight-fitting cover is provided on the front and the top of this box, through which the leads are readily accessible. If the three-way valve is closed toward the chamber, thereby intercepting the oil head upon it, the upper cover of the box can be removed without draining the oil from the box. The connections between the horizontal leads from the main transformer tank and the vertical leads going to the cable are made with movable copper links.

Against the under side of the high-voltage box a second steel chamber of oval cross-section is bolted which incases the three high-voltage leads and the ends of the cable. The two outer leads have longer copper blades than the middle one; in fact, the three blades are installed on a part of the circumference of a circle, with the bottom outlet of the cable as center. In this way it is possible conveniently to connect any one of the three conductors of the high-voltage cable to any one of the transformer leads when it is desired to change the phase rotation. This feature, together with the provision for disconnecting the transformer to allow for cable testing, is very important, and the lack of it may cause expensive delay in emergencies. The lower chamber is filled with compound and has a reservoir for surplus of this material attached to it in the shape of a 6-in. pipe 24-in. high. The box may be drained through a 2-in. valve at the bottom. A 1-in. air vent near the top permits the air to escape while the compound is being filled in. The front of this lower chamber has a large circular hand-hole and tight cover, through which the phasing out can be conveniently accomplished. At the bottom an alloy ring is provided with a collar at its lower end for a wiped cable joint and a funnel on its upper end for flaring out the lead sheath of the cable.

The necessary surface for the self-cooling action of this machine is provided in the shape of eighteen external radiators. The transformer complete weighs 88,000 lb., which includes 27,000 lb. of oil.

Overhead Distribution Construction

Standardized Practice as Developed and Used by the
WEST PENN POWER COMPANY, PITTSBURGH

Street-Lighting Transformers

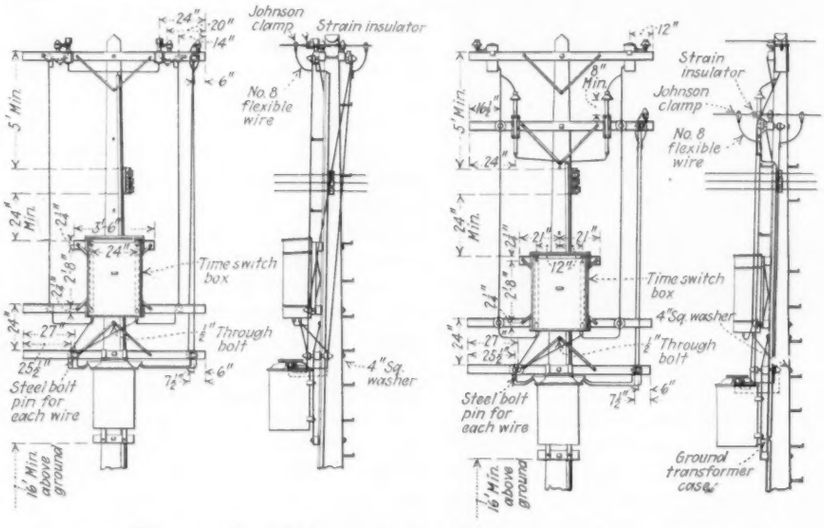
THE standard type of street-lighting system shall be the series, alternating-current, incandescent-lamp, constant-current circuit with rated current of 6.6 amp. Other systems now in operation shall be replaced by the standard system when the existing apparatus requires replacement or when large increases in capacity are necessary.

In general, all street-ligting circuits shall be supplied by moving-coil-type constant current transformers for both indoor and outdoor installations. Standard constant-current transformers shall be substituted for existing constant-potential street-lighting transformers whenever it becomes necessary to replace such transformers.

Whenever practicable indoor-type street-lighting transformers shall be installed in substations. Permanent connections for grounding and testing the circuit will be a part of all such installations. All indoor constant-current transformers will be equipped with lightning arresters on the load side. They will also have an ammeter connected in the series circuit on which the rated circuit current shall be plainly marked. Normally, standard panels equipped with such an ammeter and with switches for controlling the series circuit will be used.

All 2,300-volt standard pole-type street-lighting transformer installations will be made as shown in Fig. 68. All 6,900-volt standard pole-type street lighting transformer installations will be made as shown in Fig. 69. For both of these types at least a 40-ft. pole must be used. Lightning arresters for the primary circuit voltage shall be installed on the primary side and standard 2,300-vo t compression chamber lightning arresters shall be installed on each wire on the load side of all pole-type transformers.

A standard connection diagram is shown in Fig. 70.



FIGS. 68 AND 69—2,300-VOLT AND 6,900-VOLT CONSTANT-CURRENT TRANSFORMER INSTALLATION

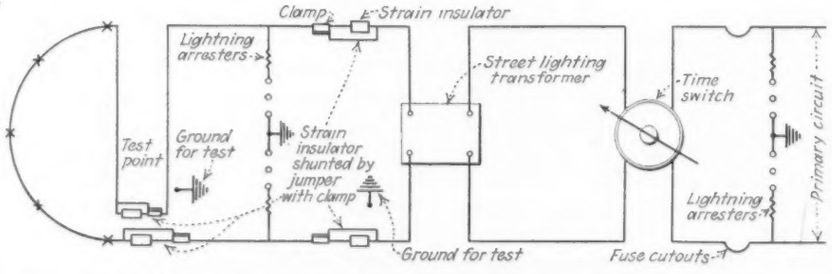


FIG. 70—SERIES LIGHTING CIRCUIT WITH TIME SWITCH AND OUTDOOR-TYPE TRANSFORMER

Floodlighting Railroad Terminals and Yards

AMONG recent uses of high-candlepower "Mazda" lamps on a large scale the employment of 1,000-watt bulbs in lighting railroad yards and terminals is to a large extent replacing the small lighting units. This kind of floodlighting came into favor during the war, when congested conditions demanded maximum efficiency, and since then, according to the Westinghouse Lamp Company, it has been generally accepted as the only successful means of getting proper night illumination in large engine and yard terminals. The use of floodlighting extends approximate daylight conditions to night work in the concentration points of railroad operations, such as engine terminals, hump yards, classification yards, freight terminals, coal piers and the like.

The floodlamps are mounted on platforms at the top of steel towers not less than 70 ft. in height. From two to eight floodlighting units, each containing a 1,000-watt "Mazda C" lamp, are installed in each tower. The total number of units depends upon the size of the yard or the area to be lighted. The apparent candlepower projected from the floodlamps amounts to from 1,200,000 to 2,400,000—enough to make every object in the yard visible.

SPOTLAMPS FOUND INADEQUATE

Spotlamps, which were heretofore regarded as the standard method of yard illumination, served their purpose very well when the yards were empty or operated at less than capacity. With capacity operation they are inadequate, the high lights and shadows being a detriment to efficiency. Take as an illustration a car rider handling two or three cars from the hump into the body of the yard for train make-up. The glare and shadows produced by spotlighting give him an inaccurate sense of speed and distance, and he is confused by the various types of cars and cannot always distinguish a flat car from a gondola. His uncertain judgment contributes to increased rough handling at night. So it is with other departments, spotlamps always tending to reduce the capacity of a road for night work. Not only is this so, but there is resultant damage to property and persons, a waste of labor and fuel and excessive loss through pilfering.

Reports of the American Railway Association indicate that rough handling, improper loading, packing, etc., caused losses to the railroads in the year 1919 of approximately $36,000,000. This figure is 34 per cent of the total damage claims paid, certainly enough largely to offset the cost of improved illumination for night service. Roads having floodlighting installations in use estimate a substantial reduction in losses due to rough handling, the floodlamps thus paying for themselves in a short time.

In connection with the claim losses due to rough handling it must also be recognized that rolling stock and equipment are frequently put out of use in this way. When a loaded car is put out of commission by rough handling there is also a labor expense attached to the transfer of its load, in addition to shortage of rolling stock, repair costs, etc.

THEFT OF GOODS REDUCED

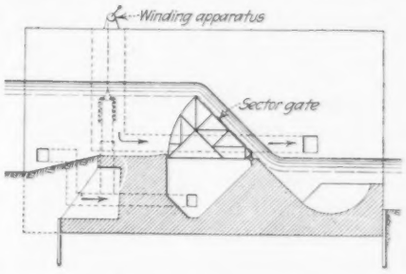
An important argument in favor of high-intensity lighting is the reduction of pilferage. Referring again to the statistics of the American Railway Association, it is found that the losses to all the railroads of the country from this cause in 1919 amounted to about $31,000,000, or 30 per cent of all claims. Criminal authorities say that the majority of all crimes are committed during the night. A conservative estimate of the reduction in pilferage losses for the period of a year will offset the fixed charge incidental to the floodlighting cost. On railroads where floodlighting is in use policing has become more effective even with a smaller force and 100 per cent efficient with a force formerly regarded as inadequate.

The labor waste during night operation, exclusive of policing, should be greatly reduced under floodlighting conditions. Better supervision of yard and engine terminal work must obviously be reflected in more efficient results and in speeding up service. Avoidance of congestion, prompt disposition, prompt loading and unloading, reduction in rehandling, more prompt switching and forwarding—all are important factors upon which floodlighting will have a favorable influence. The same number of night employees will go about their work in a more cheerful frame of mind, and with less physical effort they will accomplish a greater amount of work.

Rolling and Sector Gates for Hydro Plants

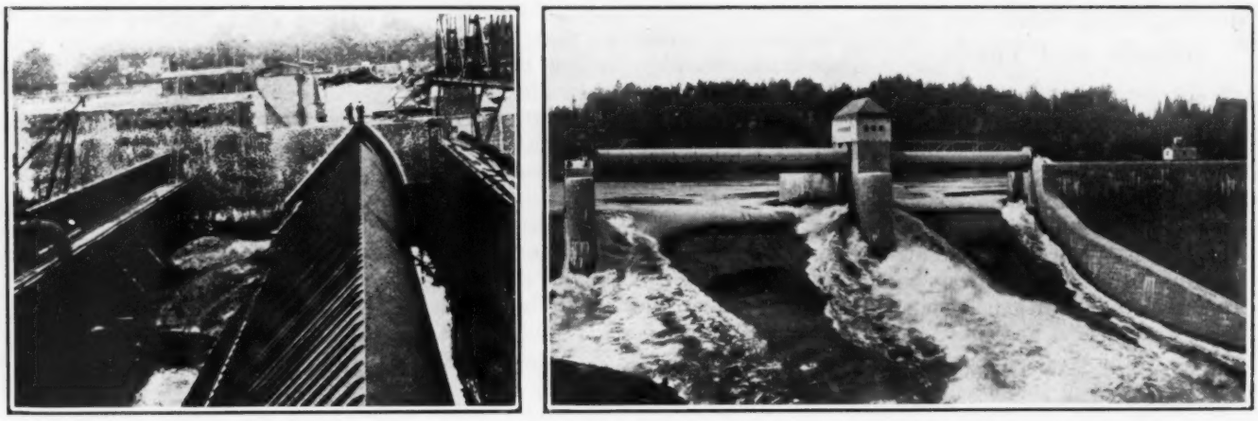
BY C. N. ANDERSON
New York, N. Y.

A TYPE of weir which is finding exceptional favor in Europe is the rolling gate, there being more than a hundred installations and 160 or more individual gates in operation there, though, with the exception of small installations at Spokane, Wash., Boise (Arrowrock), Idaho, and Grand River, Colorado, the type is almost unknown in this country. The advantages claimed for this weir are the possibility it affords of great width and height, its adaptability for streams with much ice, the small operating forces necessary, its simplicity and rapidity of operation, its extraordinary degree of watertightness and its long life and small upkeep cost.



SECTOR GATE, SHOWING METHOD OF OPERATION

The rolling-gate weir consists fundamentally of a cylinder of boilerplate, internally reinforced, with large toothed wheels at each end which run on inclined tracks. The diameter of the cylinder is the height to which the water can be raised, and gates have been built with this dimension as high as 42 ft. The length has also reached large proportions, the length of the gate at Raanaasfoss, Norway, which is the largest rolling gate as yet built, being 148 ft. The diameter of this particular cylinder is a little more than 21 ft. The contact at the bottom of the cylinder is by means of a wooden faced I-beam attached and braced to the cylinder and an I-beam embedded in the concrete of the dam structure. The gate is of such weight that it presses the wooden and steel contacts firmly together, making the contact watertight. The sides are made watertight by a similar means. An apron extends out on each end at right angles to the axis of the cylinder and has an edging of wood. The pressure of the water against the



LEFT—SECTOR GATE AT BREMEN UNDER CONSTRUCTION. RIGHT—ROLLING GATE AT VAMMA, NORWAY, IN RAISED POSITION

apron brings the wood in watertight contact with the masonry. At the Vamma power station in Norway the contact on the side is made between the wood and two iron bars placed close together in the masonry and connected at the bottom. In case the contacts are frozen together and it is desired to operate the gate (very seldom done in winter), current is supplied to the iron bars and heated sufficiently to melt the ice. The small amount of ice which forms on the bottom of the gate is not serious. The cylinder may have other forms not circular such as a shield attached to the cylinder. This is advised especially where the gate is high and not wide.

Around one end is wrapped a chain which is attached to the operating mechanism in the housing on top of the dam. By winding up this chain the cylindrical gate is rolled up the inclined track. The track on the free end is stronger than the track on the operating end as here the chain carries part of the load. In addition to the usual motor operation, it is also possible to operate by hand, but instead of the few minutes necessary to raise the gate 3 ft. or 4 ft. it would take six or eight men half an hour. In case of the failure of power during operation or at the completion of the operation, an electromagnetic air brake automatically locks the mechanism. In the case of the installation at Raanaasfoss, the lifting force is 500,000 lb., furnished by a 40-hp. electric motor.

In connection with Raanaasfoss it is also interesting to note the large sector gates which are used. The largest sector gates thus far built are on the river Weser at Bremen, Germany, and are 177 ft. long and nearly 15 ft. high. The two at Raanaasfoss are each 165 ft. long and 12 ft. 6 in. high. As this type of gate originated in America, its operation will be only briefly described.

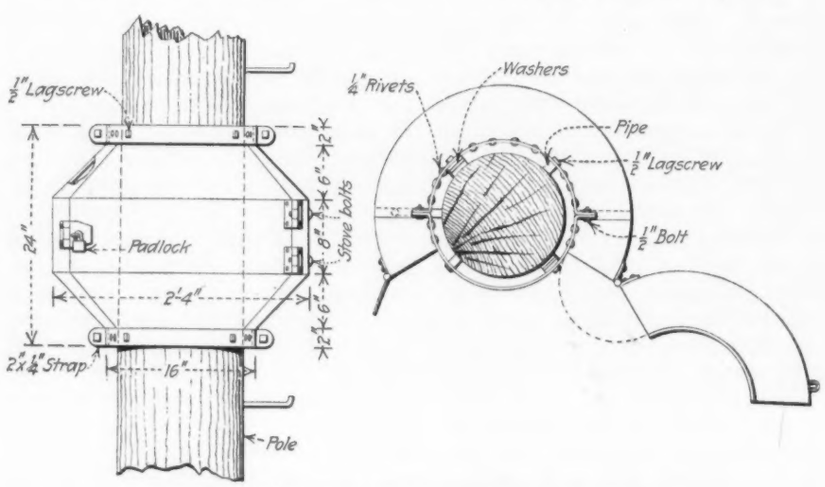
The position of the gate depends directly upon the pressure of the water in the chamber inside the gate and in the space below. This chamber is connected directly with the water above the dam and, by means of a vertical telescopic pipe, with the downstream side of the dam. The position of the vertical telescopic pipe determines the discharge height of the water inside the chamber and hence the position of the weir. By using a float in the water above the dam an electric motor can be used to operate the telescopic pipe so that with high water the discharge level will fall and also the gate. With low water the discharge level will rise and consequently the gate. This operation is adjusted so as to be entirely automatic, although hand regulation is possible. Leather is used in some cases to make the gate watertight.

This type of weir is especially valuable where there is a great deal of ice and where a large amount of timber is floated down every spring. The water is usually high at that time, and ice and timber pass over the dam without a great amount of trouble or any damage, making special tunnels and flumes unnecessary.

Construction Details of Pole Guard

IN ORDER to prevent mischievous boys from climbing poles supporting special apparatus, the Northwestern Electric Company utilizes the device shown herewith. This device is made of sheet iron and attached to the pole as shown. A swinging door that may be locked closed is provided so that linemen may still easily climb the pole. Following is the list of materials required to build one complete guard:

One shell, No. 18 sheet iron.
Two clamps, total stock 9 ft. 4 in. of 2-in. x ¼-in. strap iron.
Eight ⅜-in. lag screws.
Four 1-in. x 1½-in. machine bolts and nuts.
Two No. 6 heavy T hinges.
One No. 6 plain hinge hasp.
One padlock.
Four ⅞-in. x ½-in. stone bolts.



UNLAWFUL CLIMBING OF POLES PREVENTED BY THIS GUARD

Central Station Business

Salt Lake City Has Large Bake-Oven Load

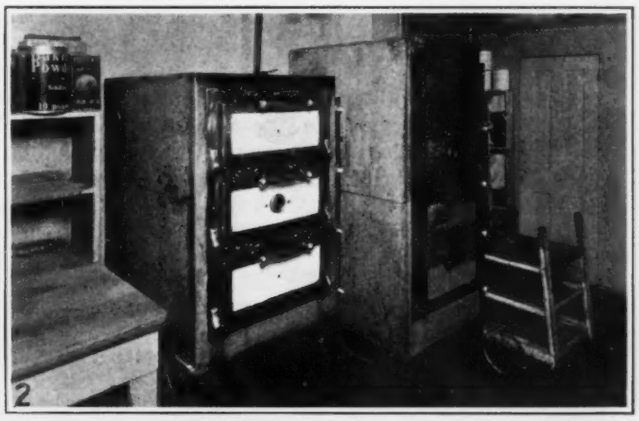
Profitable Class of Business Requires Little Additional Investment in Distribution System—Electric Bake Ovens Use More than 1,000,000 Kw.-Hr. Annually

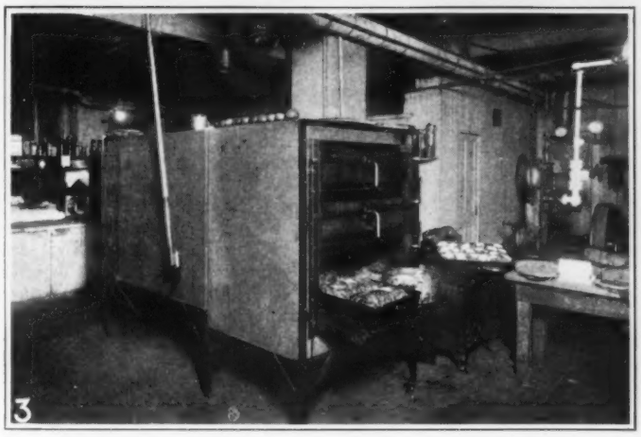
THE use of commercial electric bake ovens in Salt Lake City has progressed to such an extent that at the present time that city claims the distinction of having more of such ovens per capita than any other. It is exceeded in actual number by only one other city—Chicago, where the population is thirty times that of Salt Lake City.

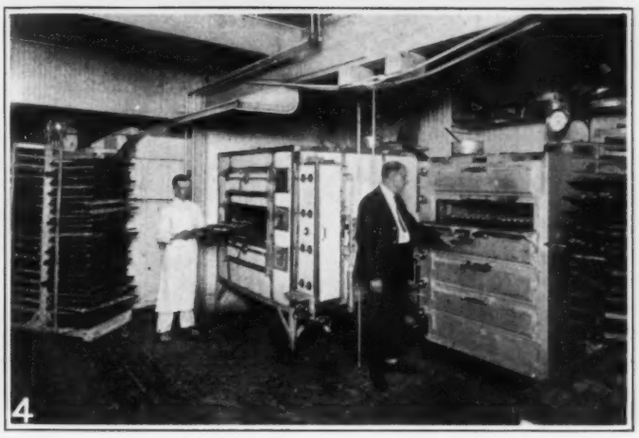
The electric bake ovens on the lines of the Utah Power & Light Company range in capacity from thirty loaves, with a connected load of 4.5 kw., to 24,000 1-lb. loaves in twenty-four hours, with a connected load of 88 kw. They are used in packing houses, cafés, cafeterias, coffee houses, domestic-science laboratories, penal institutions, hotel kitchens, retail bakeries and wholesale bakeries and are giving thoroughly satisfactory results. The cost of operation is nominal, considering the quality of the goods produced, the cleanliness, absence of odor, the accurate heat control and the ease of temperature regulation.

From the standpoint of the central-station company the bake-oven load is most desirable. The cost to connect an oven is usually low. Most of the ovens are in the commercial section, where the feeders are of ample capacity to handle the additional load. The revenue earned per kilowatt of connected load is much higher than it is for the domestic range. A large part of the baking is done during the early morning hours during the off-peak period, thereby producing a better load factor for the system. Over baking periods of seven hours or longer the electric oven will show an actual consumption of about 60 per cent of the total consumption that would be possible based on maximum demand. This enables the customer to figure fairly accurately what his bill will be under given conditions.

The use of electric bake ovens has spread from Salt Lake City over the entire system of the Utah Power & Light Company, and there are now eighty-one ovens connected to this company's lines, with an annual consumption upward of 1,000,000 kw.-hr., and an annual revenue of more than $20,000.







ELECTRIC BAKE-OVEN INSTALLATION ON THE LINES OF THE UTAH POWER & LIGHT COMPANY, SALT LAKE CITY

1. Three No. 200 Edison ovens and one electric range having a total connected load of 36 kw. are used in a pastry shop.
2. One No. 175 and two No. 150 Edison ovens, connected load 17 kw., in a grocery for baking pies and cakes.
3. One No. 2012 and one No. 220 Edison oven, connected load 26 kw., used for general baking and roasting in a cafeteria.
4. One No. 215 and one No. 300 Edison bake oven, connected load 41 kw., used for pastry, cakes and pies by a large bakery.

Public Told of Foresight in Plant Development

HOW central-station executives peer into the future for a decade in anticipating the power requirements of the communities within economic range of their generating plants forms the keynote of the accompanying advertisement inserted in Boston dailies by the Edison Electric Illuminating Company. As the new Weymouth station rises into prominence the company is seeking to increase popular interest in this addition to its generating facilities and is putting into pithy words from time to time the meaning of this development to the metropolitan and suburban areas of Greater Boston. In this way benefit to public relations is obtained from the steady progress of a technical construction job which in older days would have received only passing attention outside the engineering profession and the central station industry.

atching up with a Vision—
Watch this community of ours!
Ten years ago the men in the Edison Light whose business it is to see beyond the horizon of today into tomorrow, had a vision.
Like most practical visions, it was regarded as visionary. Some even ventured to call it preposterous.
"How can Boston possibly need 500,000 new horsepower, ten new turbines, and a generating station to cost millions of dollars," they asked, "when Boston doesn't even use all the electricity Edison Light can make now? And what's more, why build at Weymouth?"
The vision was translated into blueprints. On the margins men wrote notes of new means of producing electricity, new machines, new economies in building which struck some of the critics as alarmingly new-fangled.
That was in 191.
How the Weymouth Station is a live project. The "vision" is becoming a stupendous fact of concrete, brick, steel and stone as fast as expert engineers can work. New channels in Fore River, new fields of made ground reclaimed from the sea, caissons sunk, piers and steel-work rising, new machinery being made—all the excitement of a race against time is being experienced at Weymouth, where the builders are catching up to the vision.
For already Greater Boston's pressing the capacity of Edison Light. Every fortnight during the dark months there has come a new record day. The colossal force that is the progress of our community is hungry for the electric light and power and fuel that drives it irresistibly forward.
WATCH Weymouth Station rise: it is one measure of the growth of Greater Boston. A city like ours never quite overtakes its visions.
EDISON LIGHT of BOSTON

ADVISING THE PUBLIC OF NEW POWER STATION'S GROWTH

Results of "Bookkeeping Without Books"

Two Years' Experience of Public Service Company of Northern Illinois Favors Machine-Billing Method—Saving of Labor, Time and Money

AS A RESULT of two years' operation with a ledgerless method of accounting commonly known as "bookkeeping without books" (described in the ELECTRICAL WORLD for March 22, 1924, page 583), the Public Service Company of Northern Illinois has, besides obtaining the inherent advantages of this system itself, effected a 15 per cent saving in the cost of handling customers' accounts which will be further increased when all the improvements to the system, such as schedules of work and production standards, are completed. In one of the districts served, one having 9,000 customer accounts, the clerical force has been reduced by one, while in another district having approximately 104,000 customers a saving of ten clerks was effected. J. S. Palmer, auditor for the company, is convinced that the new system of bookkeeping is well founded and that the essentials of proper accounting have not been lost. Its installation is now complete in five districts, representing a total of 196,000 accounts, and the system is proving much more accurate and economical than the former system.

USE OF MACHINE BILLING

The principal feature of ledgerless bookkeeping—a feature which contributes greatly to the security of the record and increased accuracy in the billing and keeping of accounts—is the machine method of billing. A special Burroughs billing machine is used on this work. The operator begins by dropping the blank bill into the slot, arranged to give it the correct billing position. The machine imprints the revenue classification code numbers, the present and previous readings, the total consumption, consumption at the various rates, the gross and discount and the net amounts of the bills, all of which are copied from the meter record. The machine then automatically spaces and puts the gross, discount and net amounts of the bill both on the collection bill and on a stub called the office record. It also spaces the summary sheets and automatically returns to the first printing position, ready for the next bill.

The principal advantages of the so-called system of "Bookkeeping Without Books" are as follows:

1. There are no ledgers to rewrite at regular intervals.
2. The posting of payments is handled with greater speed.
3. Only about 20 per cent of the customers' accounts need to be handled during the delinquent period when the outstanding accounts are listed at the balancing period, since the paid bills, representing 80 per cent, are removed as the payments are received.
4. The accounts are accurately balanced instead of merely balancing the figures entered in the ledger.
5. Less storage space is required.
6. The handling of heavy ledgers is eliminated.
7. An increase of 75 per cent in the number of accounts handled per ledger clerk is attained.
8. The necessity for footing ledger columns to secure balances is obviated.

How an Enterprising Central Station Featured a Washing-Machine Sale

SPECIAL WASHING MACHINE SALE, $80 DOWN
HURLEY-THOR WASHING MACHINES AND IRONERS
HAVE YOU HAD YOUR THOR DEMONSTRATED YET? ASK ABOUT OUR EASY PAYMENT PLAN.
BIRMINGHAM ELECTRIC COMPANY

THE above view shows how the Birmingham (Ala.) Electric Company, which also operates the local traction system, advertised a special sale of washing machines and ironers. A flat car was secured, and on it the company mounted both cylinder and oscillating types of washing machines and two ironers. This car was hauled over every line of the Birmingham trolley system during the final week of a thirty-day washing-machine sales campaign conducted between April 10 and May 10. Circulars and pamphlets were given out to residents along the lines, and demonstrations were publicly made in various sections of the city and its suburbs.

9. Instead of entering meter data in two places—namely, the ledger and the meter record—it is now carried only on the meter record.

10. Accuracy in billing is increased.

11. Better attention is given to collection of delinquent accounts. This is accomplished through the inherent simplicity of the system. Since all the items are eliminated as fast as they are paid, the unpaid accounts get attention more readily.

12. The greater speed at which bills are issued reduces the time between date meter is read and date bill is delivered nearly two days.

13. Machine billing provides an actual proof of bill.

14. It furnishes a legible, neat and businesslike bill.

15. Machine billing provides a summary of the bills in chronological order at the same time they are made, from which the figures for revenue and consumption are obtained and the work of balancing is approved. This summary furnishes a compact record of all billing which can be used in building up records should either meter books or office records become lost or destroyed

The additional stub method was adopted as an office record because of its advantages under the machine-billing plan where more than one class of service is furnished. These office records are detached from the delivered bill and are filed in account number order in trays indexed according to the arrangement of the meter-reading route, remaining in these trays until the account is paid. At this time the collection bill is matched with the office record, stamped and then removed from the unpaid file and filed in the paid file. The accounts outstanding at the balancing time are those still remaining in the unpaid file. These, if they remain unpaid at the time the next bill is sent out, are transferred as delinquent bills and the office record is stamped, transferred and filed with the paid accounts for that month.

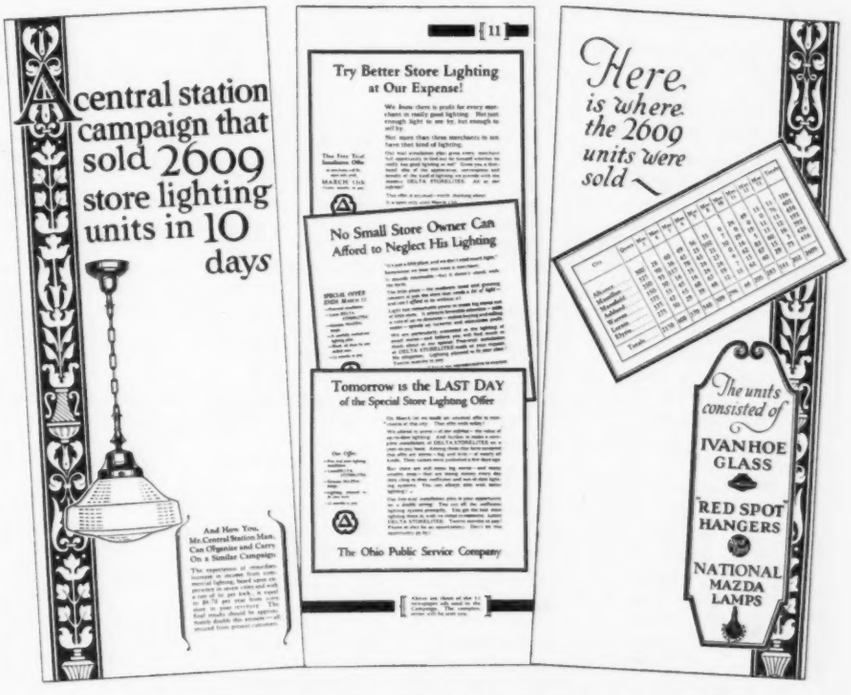
CYCLE METHOD OF BALANCING

The ledger clerk maintains a summary of all charges and credits which serves as a control for the balancing of the accounts and in making monthly reports of revenue and collection. These accounts are balanced by a system commonly referred to as the cycle method of balancing. The work of a ledger clerk is divided into units of approximately one thousand accounts. Each unit is balanced immediately after the expiration of the discount date and prior to the next billing date. This method equalizes the work of balancing throughout the month and reduces the number of outstanding accounts to be listed at the balancing period. It has greatly reduced the rush and confusion which resulted under the old system when all the balancing work was done at the end of the calendar month.

The only disadvantage of this system is the absence in case of inquiries and complaints of a chronological accounting record of each customer's transactions. This disadvantage, however, is fairly well taken care of by the entry of the gross and net amounts of the bill on the meter record. This record then serves in answering all complaints or inquiries except those referring to payments. Such inquiries must, of course, be referred to the office record. Although this takes more time than previously, it is felt that in extraordinary cases where the payment must be known for a certain period the company can well afford to devote the extra time necessary to make a thorough investigation because the savings effected by other features of the system far more than offset the additional expense thus incurred. The matter of complaints has been watched very carefully during the period of installation, and studies made of the method of handling them indicate that the change in the system has had no apparent effect one way or the other. This information was furnished through the courtesy of Harry P. Simpson, publicity manager for the Public Service Company of Northern Illinois.

Co-operative Campaign Sells 2,609 Store Lighting Units

THE Ohio Public Service Company, in co-operation with three lighting equipment manufacturers, the Ivanhoe Works of the Miller Company, the National Lamp Works of the General Electric Company and the F. W. Wakefield Brass Company, made an outstanding success of a daylight kitchen campaign in the territory served by the central-station company. Based on the experience gained in that sale, the central station and the three manufacturers launched another campaign plan designed to stimulate better store lighting, especially in the smaller stores, which generally are poorly lighted. The plan has been carefully developed and has had a practical test in seven communities having altogether 6,370 stores of all sorts. The result was sales of 2,609 units in ten days, which paid a merchandising profit of approximately $15,000 and brought the lighting company approximately $30,000 per year increased revenue.


A central station campaign that sold 2609 store lighting units in 10 days
Try Better Store Lighting at Our Expense!
No Small Store Owner Can Afford to Neglect His Lighting
Tomorrow is the LAST DAY of the Special Store Lighting Offer
The Ohio Public Service Company
Here is where the 2609 units were sold
The units consisted of
IVANHOE GLASS
"RED SPOT" HANGERS
NATIONAL MAZDA LAMPS

HOW A SUCCESSFUL STORE-LIGHTING CAMPAIGN WAS CONDUCTED

How this campaign was organized and operated is told in a booklet, "A Central-Station Campaign That Sold 2,609 Store-Lighting Units in Ten Days," which has just been published co-operatively by the three interested manufacturers and may be obtained from them or the Ohio Public Service Company in Cleveland.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Photostat copies or English translations of complete articles will be furnished at cost upon request

Hydro-Electric Development and Steam Equipment

Protection of Steam-Turbine Disk Wheels from Axial Vibration.—W. CAMPBELL.—The first of a series of articles covering a full and detailed description of work done in studying various forms of vibration and waves which may exist in steam-turbine disk wheels. The first article outlines the trouble which gave rise to the investigation and reviews the various preliminary channels along which the study was conducted.—*General Electric Review*, June, 1924.

Practical Coal Carbonization.—F. W. SPERR, JR.—The subject is presented from the standpoint of the power engineer who is constantly being confronted with the question of the better use of bituminous coal. It is a discussion of low-temperature and high-temperature carbonization with special reference to American conditions. Low-temperature carbonization offers a very interesting field of possibilities in the way of new processes and new products, but it should be thoroughly realized that no low-temperature process has yet proved commercially successful and that there are serious difficulties, both economic and technical, in the low-temperature carbonization of coking coals, especially under American conditions. In this country the best plan of development would appear to be along the lines of improving the processes of high-temperature carbonization as applied to coking coals, extending the uses of coke and byproducts and directing the application of low-temperature carbonization toward the field of the poorly coking or non-coking coals.—*Mechanical Engineering*, June, 1924.

Effect of Coal Ash on Refractories.—J. J. BRENNAN.—Compiled data with charts on tests conducted by the Northern States Power Company, showing the effect of fusing of various grades of brick with different grades of coal, are given.—*Combustion*, June, 1924.

Generation, Switching, Control and Protection

Emmet Mercury-Vapor Process.—W. L. R. EMMET.—The author gives an account of the early experiments made, after which the thermodynamic possibilities of the process are taken up. The 1,800-kw. installation in the plant of the Hartford Electric Light Company is then described, following which boiler problems, leakage, packing and related topics are discussed, as well as the question of mercury supply. In the type of boiler which is now considered most promising dead-ended tubes with interior structures provide the circulation conditions for each tube independently. These tubes are arranged in such a manner that they receive radiant heat from below, the gases passing upward in rather small and converging spaces between them. The arrangement is such that all tubes receive nearly equal quantities of heat both from radiation and from contact with the gases. An appendix to the paper includes a table of the properties of mercury vapor at absolute pressures ranging from 0.4 lb. to 180 lb. per sq.in. absolute, a Mollier chart for mercury, and a chart showing the available energy of mercury vapor in watt-hours per pound for expansions from absolute pressures of from 20 lb. to 85 lb. per square inch to back pressures of from 0.4 lb. to 1.6 lb. absolute.—*Paper presented before the A. S. M. E., Cleveland*, May 26-29, 1924.

Replacing Steam Plant by a Diesel-Engine Plant.—The Arkansas & Missouri Power Company at Caruthersville, Mo., operated an obsolete steam plant for supplying both electricity and ice. By replacing this plant with Diesel engines the generating cost was reduced from 6 cents to less than 1 cent per kilowatt-hour. The complete change-over is described.—*Power*, May 13, 1924.

Transmission, Substations and Distribution

Switch House of the Twente Station in Holland.—L. C. PABON.—In the event of an oil-circuit-breaker explosion in a cell, the gases may blacken and decrease the insulation of the bushings of breakers in neighboring cells. Part of the switch house may be rendered inaccessible. To prevent this the following construction has been made in this station: A gallery in the center has two fireproof walls with only small openings for control wiring. On the other side of these walls the breakers are mounted in individual cells. The two rows of concrete cells open into open galleries that are in direct and free communication with the outside air. On this side the cells have doors of iron frame, covered with very thin ebonite. Meters, relays, signal lamps, etc., are mounted on a frame. A thin sheet iron with holes for meters and apparatus covers all wiring. For inspections the sheet iron can be easily removed.—*Sterkstroom (Holland)*, March 26, 1924.

Theoretical and Technical Details of the "Transverter."—The transverter is a machine to transform alternating current at voltages such as are used for the generation of electrical energy into direct current at pressures of the order of 100,000 volts. Essentially it may be regarded as a combination of the static transformer and rotary converter with advantages that are all its own. The principal difference is that the phase multiplication which is necessary in converting alternating to direct current is carried out in the static and not in the moving part of the equipment. This has led to an unusual arrangement of transformers. In the transformer portion three-phase current is converted into thirty-six-phase current which traverses a closed ring winding and is tapped off to the commutator segments on ten commutators, each of which is swept by two brushes 90 deg. apart. A fixed commutator has been chose for mechanical reasons and because a higher degree of insulation is possible.—*Electrican*, May 9; *Engineering* May 2, and *Engineer*, May 16, 1924.

Reducing Line Losses in Power Systems.—W. RUNG.—Several of the power systems in Denmark operate with a relatively low efficiency. The main part of the excessive losses is attributed to copper losses in lines and transformers. The author shows that about 75 per cent of these losses are due to wattless current. Owing to the complexity of the distribution networks it is impractical to correct this condition by synchronous motors. It is shown that a proper correction of the power factor can be obtained by condensers connected to the low-tension side of the transformers. These condensers can be procured at a sufficiently low cost to make the correction worth while. The author computes the most advantageous value of the correcting current for different conditions. This value is given as a function of the magnitude of the wattless current, the price per kilowatt-hour, the yearly cost per ampere for capitalization and maintenance of the condensers, the line resistance, etc. In a specific example, selected from Danish conditions, it is shown that a reduction of the losses of 27 per cent can be obtained by this method.—*Teknisk Tidskrift (Sweden), Elektroteknik*, May 3, 1924.

Illumination

Testing Colored Material for Fastness to Light.—H. S. THAYER.—The author describes a series of experiments on various colored materials exposed to light sources of different kinds. A number of illustrations are used, consisting of comparison spectra of the sun, the mercury arc and the violet arc, and also the commercial form of the violet carbon arc. Several tables of interesting data and one set of curves showing variation in the intensity of sunlight with time of day and season of the year are inc'uded.—*Transactions of I. E. S.*, April, 1924.

Units, Measurements and Instruments

Reluctivity of Permalloy.—A. E. KENNELLY.—The author points out in this short article that the bilinear graph of reluctivity of the new magnetic metal permalloy is remarkably well maintained and is no exception to the general rule of magnetic metals in this respect.—*Journal of Franklin Institute*, May, 1924.

Method and Apparatus for Measuring Dielectric Strength of Liquids and Compounds.—R. DIETERLE.—For the exact determination of puncture voltages for liquid insulating materials

and cable compounds, all existing testing apparatus gives more or less erratic values, which may be traced to a number of influencing factors either characteristic of the particular apparatus used—chiefly the shape of its electrodes—or caused by the testing method. The most frequently employed electrode forms are (1) plate to plate, (2) round rod within a hollow cylinder, (3) cone within a hollow cone, (4) two spheres, (5) needle to plate, and (6) two needles. The author investigates each of these arrangements, calling attention to their particular advantages and disadvantages both from the theoretical and the operating standpoint. None of these arrangements would be suitable for standardization as high accuracies and consistency of results are required. For each of these six classes of testing apparatus a large number of test data are given to illustrate the variance of results. Desirable properties of a dependable test gap and method which would furnish an apparatus suitable for accurate data are described. A sphere concentric to a hollow half sphere (25 mm. radius and 27 mm. radius respectively) is suggested as the most promising electrode shape.—*Elektrotechnische Zeitschrift*, May 22, 1924.

Relation Between the Tensile Strength and the Electrical Resistivity of Copper.—W. E. ALKINS.—The author recently undertook a series of experiments with the object of investigating the connection between the increase in resistivity of hard-drawn, commercially pure copper and its tensile strength. The preparation of test wires, the actual method of testing and the results obtained are considered.—*World Power* (*England*), May, 1924.

Heat Application and Material Handling

Alternating-Current Arc Welding.—F. WORTMANN.—Careful investigations with the oscillograph during the practice welding disclosed a certain rectifying action of the alternating-current welding arc caused by the potential difference between the positive and negative half waves. With suitable coating of the welding electrode and a proper phase displacement between load and no load of the welding machine the striking and maintaining of the arc are satisfactory. Observed average values for energy consumption and time required show great savings for the alternating-current arc welding. The actual speed of the electrode melting is always greater than the theoretically calculated value. This may be due to the constant vibration of the liquid drops at the working end of the electrode, caused by the frequency of the current. The amount of heat transferred to the work is 36 per cent less than for direct current. Properly used, the author claims that alternating current is applicable to every welding job.—*Elektrische Betrieb*, May 10, 1924.

Material-Handling Problems Encountered in the Assembly of Automobiles.—M. R. DENISON.—This paper is a description of the time-saving and labor-saving methods devised for the handling and inspection of raw materials and finished parts in a large modern automobile-manufacturing plant. It deals with the functioning of stores divisions, service departments, loss of material, reductions effected in amount of clerical labor required, instruction of storeroom men, location of storerooms, handling sheet metal, transportation, final car assembly, etc.—*Mechanical Engineering*, June, 1924.

Mercurial Poisoning.—J. A. TURNER.—The investigations presented in this pamphlet were conducted in a government metallurgical laboratory where several chemists had complained of mercurial poisoning. It was found that the mercury came from the operation of two electric induction furnaces. These electric furnaces are of types similar to those used in certain industries, but are smaller, and therefore this study is of added significance because of its direct relation to industrial hygiene and particularly to the occurrence of mercurial poisoning among industrial operators.—*Reprint No.* 903 *from the Public Health Reports.*

Electrophysics, Electrochemistry and Batteries

Electrolytic Tank House of the Chile Exploration Company.—C. W. EICHRODT.—These tanks are constructed of concrete and are lined with acid-proof mastic. Details of tank-house operation are given, including complete analyses of electrolyte, starting sheet manufacture, mechanical handling of the copper, proper spacing of electrodes and electrical equipment.—*Paper presented by the American Electrochemical Society, Philadelphia*, April 24-26, 1924.

Ferromagnetism and Its Dependence Upon Chemical, Thermal and Mechanical Conditions.—L. W. MCKEEHAN.—The great stimulation afforded to electrical theory by the discovery of the electron and the intensive study of its properties illustrates what may be expected in magnetic theory when the properties of the corresponding natural magnetic unit become accessible to investigation. Recent experimental work, reviewed in the theoretical part of this paper, makes it extremely probable that this magneton, as it is called, has already been directly observed. The author surveys the existing state of knowledge in regard to magnetism in order to see whether there is a respectable body of data which may be used in testing the new and growing theory of magnetism. The article is to be concluded in a forthcoming issue.—*Journal of the Franklin Institute*, May, 1924.

Symposium on Effect of Temperature Upon the Properties of Metals.—A symposium of four papers presented at the Cleveland convention of the A. S. M. E. and A. S. T. M. May 29 last, giving a review of the present state of knowledge of the properties of metals at various temperatures and a discussion of the necessity for promoting further knowledge. The symposium embraced: "Industrial Applications of Metals at Various Temperatures," by L. W. Spring; "Methods of Testing Metals at Various Temperatures and Their Limitations," by V. T. Malcolm; "Available Data on the Properties of Irons and Steels at Various Temperatures," by H. J. French and W. A. Tucker, and "Available Data on the Properties of Non-Ferrous Metals and Alloys at Various Temperatures," by C. Upthegrove and A. E. White.

Scattering of X-Rays.—I. MAIZLISH.—The author presents a discussion of the possibilities of modifying the J. J. Thomson theory on the subject so as to account for the decrease in the scattering coefficient as well as the dissymmetry. By assuming that the electron is made up of a number of parts—for simplicity, of two parts—it has been found possible to account for the diminution in the scattering coefficient without at the same time explaining the observed asymmetry.—*Journal of Franklin Institute*, May, 1924.

Traction

Snow Protection for Mountain Railroads.—G. R. LORANGE.—This article gives an abstract of an extensive report of the state railroads in Norway. It discusses in detail the different types of protective measures (stationary snow shields and roofing) which have been found advantageous for Norwegian conditions.—*Teknisk Ukeblad* (*Norway*), Feb. 1 and 8, 1924.

Mechanical Features of Gearless-Traction Elevator Motor and Brake.—J. J. MATSON.—A description is given of the mechanical features of the gearless-traction type of elevator machine.—*General Electric Review*, June, 1924.

Telegraphy, Telephony, Radio and Signals

Telephone Development in the United States and Abroad.—R. S. COE.—The author shows how a high degree of telephone development has been attained in certain foreign countries despite the limitations and handicaps imposed by public ownership. The great progress that has been made in America can be attributed to the freedom which the companies have been enabled to exercise. Figures actually show that 63 per cent of the world's telephones are in the United States, while the population is only 6 per cent of the world's total population.—*Bell Telephone Quarterly*, April, 1924.

A Reactance Theorem.—R. M. FOSTER.—The theorem gives the most general form of the driving-point impedance of any network composed of a finite number of self-inductances, mutual inductances and capacities. This impedance is a pure reactance with a number of resonant and anti-resonant frequencies which alternate with each other. Any such impedance may be physically realized (provided resistances can be made negligibly small) by a network consisting of a number of simple resonant circuits (inductance and capacity in series) in parallel or a number of simple anti-resonant circuits (inductance and capacity in parallel) in series. The proof of the theorem is based upon the solution of the analogous dynamical problem of the small oscillations of a system about a position of equilibrium with no frictional forces acting.—*Bell System Technical Journal*, April, 1924.

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rullings and News of Electrical Men

Next N. E. L. A. Convention to Be Held on Coast in June

The date for the next annual convention of the National Electric Light Association has been fixed for the week beginning June 15, 1925. While the convention will be held on the Pacific Coast, some doubt exists as to the city in which it will be held. San Francisco has solicited the meeting, and telegrams have been received from the Mayor, the San Francisco Chamber of Commerce and numerous other organizations urging the association to come to the city at the Golden Gate. On the other hand, the claims of Portland, the home of the president of the N. E. L. A., cannot be ignored. If after a thorough canvass of the hotels the local Chamber of Commerce can guarantee enough and suitable hotel accommodations, the convention may go to Portland, which possesses an excellent auditorium large enough for all the meetings. President Franklin Griffith is naturally anxious that the Rose City shall be the host of the convention, but is reconciled to San Francisco if Portland cannot accommodate the meeting.

Griffith Announces Organization Personnel of N. E. L. A.

Franklin T. Griffith, president of the National Electric Light Association, has announced the following organization personnel for the next administrative year, the chairmen, announced last week, being here repeated:

Public Relations National Section—Chairman, M. S. Sloan, president Brooklyn Edison Company. Vice-chairmen, H. C. Abell, vice-president Electric Bond & Share Company, New York; E. A. Barrows, president Narragansett Electric Lighting Company, Providence, R. I., and W. H. McGrath, vice-president Puget Sound Power & Light Company, Seattle.

Accounting National Section—Chairman, W. Paxton Little, treasurer Niagara Falls Power Company. Vice-chairmen, W. C. Lang, Electric Bond & Share Company, New York, and A. R. Patterson, Stone & Webster, Boston.

Commercial National Section—Chairman, W. R. Putnam, vice-president and general manager Idaho Power Company, Boise. Vice-chairmen, F. D. Pembleton, Public Service Electric & Gas Company, Newark, N. J., and George R. Jones, Public Service Company of Northern Illinois, Chicago.

Technical National Section — Chairman, H. P. Liversidge, vice-president Philadelphia Electric Company. Vice-chairmen, C. F. Hirshfeld, chief research department Detroit Edison Company; L. M. Klauber, general superintendent San Diego (Cal.) Consolidated Gas & Electric Company, and W. K. Vanderpoel, general superintendent of distribution Public Service Electric & Gas Company of New Jersey.

These chairmen of special national committees have been appointed:

Constitution and by-laws—W. C. Eglin, vice-president Philadelphia Electric Company.

Prize awards—T. I. Jones, general sales agent Brooklyn Edison Company.

Electrical resources of the nation—C. E. Groesbeck, vice-president Electric Bond & Share Company, New York.

Electrification of steam railroads—F. R. Coates, president Toledo Edison Company.

Finance—J. B. McCall, chairman of the board Philadelphia Electric Company.

Lamps—Frank W. Smith, vice-president United Electric Light & Power Company, New York.

Public Policy—Martin J. Insull, vice-president Middle West Utilities Company, Chicago.

Rate Research—Alex Dow, president Detroit Edison Company.

Water-power development — W. E. Creed, president Pacific Gas & Electric Company, San Francisco.

Educational—Fred R. Jenkins, Commonwealth Edison Company, Chicago.

Insurance—Charles B. Scott, Bureau of Safety, Chicago.

Membership—Howard K. Mohr, Philadelphia Electric Company.

Rural service—G. C. Neff, vice-president Wisconsin Power, Light & Heat Company, Madison, Wis.

Wiring—R. S. Hale, Edison Electric Illuminating Company of Boston.

Civil Engineers Differ on Colorado Development

A lively discussion took place at the recent San Francisco convention of the American Society of Civil Engineers over a paper by Col. William Kelly, chief engineer of the Federal Power Commission, on "The Colorado River Problem." A. P. Davis, J. C. Allison, F. H. Fowler, Louis C. Hill, E. C. LaRue, Major H. S. Bennion and William Mulholland presented views from different angles on power and irrigation needs in the Colorado River basin, some opposing and some defending the Boulder Cañon dam. The Mojave reservoir was advocated as a means of solving several of the more troublesome problems and was also vigorously decried as the revival of a scheme undesirable and ill-advised which was long ago abandoned as impracticable. Speakers mentioned the great importance of an agreement with Mexico before any extensive storage work was undertaken.

Democratic Planks on Muscle Shoals and Water Power

The platform adopted last Saturday by the Democratic National Convention at New York contained these planks and parts of planks of especial interest to the electric power industry and other advocates of water-power development:

"Muscle Shoals and Fertilizers.—We reaffirm and pledge the fulfillment of the policy with reference to Muscle Shoals as declared and passed by the Democratic majority of the Sixty-fourth Congress in the national defense act of 1916, 'for the production of nitrates or other products needed for munitions of war and useful in the manufacture of fertilizers.' We hold that the production of cheaper and higher-grade fertilizers is essential to agricultural prosperity. We demand prompt action by Congress for the operation of Muscle Shoals plants to maximum capacity in the production, distribution and sale of commercial fertilizers to the farmers of the country, and we oppose any legislation that limits the production of fertilizers at Muscle Shoals by limiting the amount of power to be used in their manufacture.

"Conservation.—We pledge . . . revision of the water-power act. . . . We believe that the nation should retain title to its water power and we favor the expeditious creation and development of our water power. We favor strict public control and conservation of all the nation's natural resources.

"Flood Control and Water Transportation.—. . . Flood control and the lowering of flood levels is essential to the safety of life and property, the productivity of our lands, the navigability of our streams and the reclaiming of our wet and overflowed lands and the creation of hydro-electric power. We favor the expeditious construction of flood relief works on the Mississippi and Colorado Rivers and also such reclamation and irrigation projects upon the Colorado River as may be found to be feasible and practicable. We favor liberal appropriations for prompt co-ordinated surveys by the United States to determine the possibilities of general navigation improvements and water-power development on navigable streams and their tributaries, to secure reliable information as to the most economical navigation improvements in combination with the most efficient and complete development of water power. We favor suspension of the granting of federal water-power licenses by the Federal Power Commission until Congress has received reports from the Power Commission with regard to applications for such licenses."

Tornado Destroys Stack

Substation Blown Over and Lines Are Down, but Lorain Rises to the Emergency—Sandusky Little Hurt

THE tornado that wrought such great destruction of life and property at Lorain, Ohio, last Saturday and made itself felt in other cities and towns in that part of the state did not leave the electric light and power industry unscathed. Lines went down in many directions, and at Lorain a brick smokestack at the local plant and a substation structure were demolished. With the energy characteristic of the industry and the region, steps at rehabilitation began almost the moment the storm was over, and full recovery is likely to be made in an extraordinarily brief space of time. The total damage to the electric system at Lorain is put at about $150,000, evenly divided between the injury to the stations and that to transmission and distribution lines.

VIGOROUS RESTORATION WORK

From J. B. Johnson, manager of the Lorain division of the Ohio Public Service Company, comes the following account of the injury and of the restoration plans:

"Replying to your telegram requesting information on the extent of the damage to our plant system at Lorain because of the tornado, the damage to the Edgewater power station, our main generating plant, consists of the destruction of one 275-ft. brick stack with some injury to the building caused by falling stack material. No damage was done to any of our generating equipment, boilers or switchboards. A steel-framework outdoor substation recently erected was completely blown down, but without damage to transformers or oil circuit breakers other than the destruction of insulators. We estimate that damage to our stations will aggregate approximately $75,000, which is completely covered by tornado insurance. Our 22,000-volt transmission lines from Edgewater station, aggregating five in number, were all destroyed through the storm area, and one steel tower on our 132,000-volt transmission system was destroyed, but normal service was restored over two of our 22,000-volt lines within twenty-four hours after the tornado, and the others were speedily put back into service.

"Our distribution system and street-lighting system, covering an area approximately one-half mile wide and one and one-half miles long, has been almost completely destroyed, as well as all residences and business houses in this district. We are, however, making rapid progress at restoration with the assistance of the repair crews from other Ohio Public Service properties and from the Cleveland Electric Illuminating Company. Emergency service was restored in hospitals and other vitally essential points on Sunday morning following the storm, and we expect to have service restored in all Lorain city, except the devastated district, by Tuesday noon. New distribution pole lines were built through the devastated district to supply service wherever it could be used by Wednesday night. We estimate that the loss to our transmission and distribution system will aggregate about $75,000. Provisions have already been made to rebuild on a much improved scale as compared with our former distribution system, and these plans are being worked in with our reconstruction program.

"A very small percentage of our investment in power plants, substations, transmission and distribution lines has been affected, and there are ample reserves, previously set up, for all reconstruction work necessary to restore full service to the entire system. The recovery which was made in forty-eight hours through the assistance of the various companies in this section was an early indication that the situation would be vigorously met."

In response to a telegram from the ELECTRICAL WORLD, word came from C. B. Wilcox, vice-president and general manager of the Sandusky Gas & Electric Company, that the plant of that company was not in the path of the tornado and that the company's loss will probably not exceed $7,500. There was no damage whatever to the station or the station equipment. Distribution lines in one small portion of the city only were put out of service. All other residential and power service as well as the "white way" service continued in full operation, and complete residential street lighting was resumed in two or three days.

Damage by Storm in Illinois and Iowa

With the exception of a few isolated cases, the damage to properties of the Illinois Power & Light Corporation in the path of the tornado that swept through central Illinois and Iowa early last Saturday has been repaired and electric service resumed. The properties at Des Moines, Iowa, suffered the most damage. Many poles were blown down and large trees uprooted and blown across power lines, throwing the city in darkness. At Peoria, Ill., and along the lines of the Illinois Traction System considerable damage was done to power lines, interrupting streetcar and interurban train service. Damage was also done to the company's properties at Galesburg, Ill. Consumers in the areas where big central stations are operated were less inconvenienced by the floods and tornado than those in the district where small-company or municipal plants are operated, owing to the greater facilities of the large plants to handle such emergencies. The storm had hardly ceased before large crews of engineers and linemen of the company recruited from properties in cities that were out of the path of the tornado were on their way to the stricken areas, and within a few hours they were at the scene of the disaster, resetting poles, stringing wires and repairing the damage. In some instances temporary service was resumed within a few hours.

Public Relations Again Dominant Topic

Northwest Electric Light and Power Association Convention Stresses the Importance at This Time of Good Understanding Between Utilities and People

PUBLIC relations were almost the sole topic of discussion at the seventeenth annual convention of the Northwest Electric Light and Power Association, held at Gearheart, Ore., on June 25, 26 and 27. This phase of utility operation was felt to be first in importance at the present time. Four general meetings were devoted largely to the subject.

President George L. Myers in his opening address on the first day spoke of the apparent lack of interest on the part of committeemen and said that central-station executives must lend their active support and see to it that their men attend committee meetings if the greatest good is to result from the work of the association. Franklin T. Griffith, president-elect of the National Electric Light Association, who followed, deplored the fact that the public is being misinformed by pernicious propaganda appearing in the daily press which apparently emanates from authoritative sources but which actually contains palpable falsehoods. He urged that the efforts of utilities be directed to counteract this influence.

That superpower is rapidly becoming an accomplished fact was brought out by M. H. Aylesworth, managing director of the N. E. L. A. It simply means the continuation of the present policy of interconnecting the generating systems of central stations for the ultimate benefit of the consumer in better service and lower rates.

Irving E. Vining, president of the Oregon State Chamber of Commerce, speaking on the subject of "The Potential Tomorrow," said the electrical industry must talk the language of the people and must meet the public on its own ground, learn its problems, gain its confidence and then work shoulder to shoulder in furthering the progress of the nation. In addressing the convention on the subject of "Government in Business," George A. Hughes, Chicago, said that there are three principal weaknesses in government ownership—first, the machinery of government is too inflexible to meet properly the changing conditions of modern business; second, problems are treated from the viewpoint of the politician rather than that of the business man; third, municipal, state or federal adventures in business have consistently proved to be economic failures.

R. F. Pack, Northern States Power Company, Minneapolis, in speaking on public relations, said that satisfactory public relations provide the answer to government ownership. In attacking the utilities, he said, the socialists and politicians have chosen the most vul-

nerable spot in the business of the nation in a program which has as its ultimate aim the control of the three necessities of life—food, clothing and shelter. He pointed out that when the small business man and the farmer vote for government ownership of utilities they are only deluding themselves, for they are supporting a program which means their own ultimate elimination from the business life of the nation.

In the discussion on the electric range survey which is proposed in the Northwest, M. H. Aylesworth said that the work has been held up for lack of funds, but that the manufacturers have now agreed to supply the $25,000 needed and the work is to go ahead along the lines originally planned. The work will be carried out under the direction of the N. E. L. A. by the Northwest Electric Light and Power Association, and a comprehensive analysis of the entire range situation will be made during the next two years.

At the executive session at the close of the convention R. M. Boykin, manager of the southern district of the Puget Sound Power & Light Company, Portland, was elected president of the association for the ensuing year. Vice-presidents were elected as follows: J. P. Lotteridge for Oregon, R. B. King for Idaho, D. C. Green for Utah and Norwood Brockett for Washington. Montana was not represented, and a vice-president for that state will be appointed later.

Illinois Miners Favor "Giant Power" for that State

A somewhat unusual resolution for a trade union convention to pass was adopted by the Illinois mine workers assembled at Peoria on the recommendation of their president. It advocated the reorganization of the coal industry in Illinois through "the establishment of one or more giant power plants on the Ohio and Mississippi Rivers for the manufacture of electricity, an integrated network of major and minor power lines to make electricity available to every hamlet and farmhouse in the state and the distillation of coal at or near the giant power stations in order to save the by-products of coal which are now wasted."

"The benefits anticipated from the plan suggested," said the report, "are: (1) An increased demand for Illinois coal through the substitution of electric light for kerosene light, the substitution of electric power for gasoline power, the substitution of electric stoves for wood, oil, gasoline and crude-oil burning stoves, the more extensive use of electrical labor-saving devices in home and farm, such as washing machines, vacuum cleaners, corn shredders, etc., the illumination of concrete highways, and the substitution of artificial anthracite for fuel oil in heating plants; (2) a marked reduction in the price of light, heat and power at the expense of waste in transportation, selling and delivery; (3) the stimulation of industry by a steady supply of light, heat and power at reasonable prices; (4) the abolition of the smoke nuisance; (5) cheaper fertilizer for the reclamation of farm land, and (6) steady employment of our members."

The resolution condemned "gigantic private monopolies" and thought the anticipated change should be brought about by "semi-public service corporations in which producer and consumer are directly interested."

Four Years' Growth

Geological Survey Figures Show One-third Increase in Electric Power Plant Efficiency

SIXTEEN tables just published by the Geological Survey give a purported summary of the annual production of electricity and the consumption of fuel by electric utility plants for the years from 1919 to 1923 inclusive. The tabulations of the Geological Survey, however, show that included in its statistics are returns not only from electric railway power houses but also from reclamation service and certain manufacturing plants, the total from these three sources being between 4,500,000,000 kw.-hr. and 5,000,000,000 kw.-hr. In this respect the Geological Survey's figures differ from those of the ELECTRICAL WORLD, which are confined strictly to the plants of the electric light and power companies.

The figures of the Geological Survey show for each state the trend during the last four years in generation by water power and in the consumption of coal, oil and gas in producing electricity. The information is based on monthly reports from about four thousand power plants with a total generating capacity of nearly 18,000,000 kw. The figures establish:

1. That in four years the electricity generated for public use has grown from 39,000,000,000 kw.-hr. to 55,700,000,000 kw.-hr., or 43 per cent.

2. That the product of a ton of coal has increased from 625 kw.-hr. to 835 kw.-hr., an increase of 33⅓ per cent.

3. That the proportion of water-power to steam production has decreased from 37.5 per cent to 34.8 per cent. In 1923 about 19,333,000,000 kw.-hr. was produced by water power, saving 23,250,000 tons of coal.

The relative standing of the seven states that lead in the production of electricity did not change in the four years. New York is first with nearly 16 per cent of the total for the United States, Pennsylvania is second with nearly 10 per cent, and California third with a little more than 9 per cent. In water-power production California ranked first from 1921 to 1923 with from 21 to 22 per cent of the total. New York, which ranked first in 1920, is now second with about 18 per cent. In steam production the first three states in 1920 were, in the order named, New York, Pennsylvania and Ohio, but in 1923 Illinois took third place away from Ohio. In consumption of oil as fuel for the production of electricity California is naturally first, but fell from 43 per cent in 1920 to 22 per cent in 1923. Texas comes second with about 21 per cent. Rhode Island, which ranked eighth in 1920, advanced to third place in 1923.

Cut Expense, Not Effort

This Advice Sounds Keynote of Lighting Equipment Men's Meeting at Atlantic City

"PRESENT business conditions demand that we economize and reduce overhead in every way, but this is, above all others, the time to increase sales efforts and advertising expenditures," declared Bernhard Blitzer, president of the Lightolier Company, New York City, in addressing the National Council of Lighting Equipment Manufacturers, in session at Atlantic City, June 25 to 27. Mr. Blitzer has been called the "dean of the fixture business."

"In the lighting fixture business," continued Mr. Blitzer, "sales volume for recent months is off by 15 to 20 per cent. The building boom is coming to an end. Already finance firms which formerly granted builders 66 per cent on first mortgages will allow only 50 per cent, and even this must be amortized quarterly or monthly. Electrical men will accordingly do well to watch their step and to adapt their sales organizations to the changed conditions—back, in fact, to the situation of the pre-war years.

"Watch overhead, for overhead is the one thing that lives forever unless killed," counseled Mr. Blitzer. "Reduce expenses. Save on car fares and all incidental items which are not directly productive. But at the same time increase your sales effort and sales effectiveness. Spend more money in ways that will increase merchandise sales. Our concern is cutting down expenses and even saving on car fares, but we are also right now increasing our sales budget and our advertising appropriations."

Herman Plaut, president of the National Council, outlined the achievements of the body through co-operative action, and C. H. Hofrichter, executive secretary, presented a statistical review of the lighting industry and emphasized the need for further industry analysis.

Albert Wahle, New York City, defined higher standards in the fixture business—in designs, materials, workmanship, efficiency and selling methods. Edwin B. Gillinder, Port Jervis, N. Y., spoke on "Glass and Its Proper Attachment to Fixtures"; W. L. Goodwin, Society for Electrical Development, outlined plans for the lighting essay contest, and George J. Klein, Cleveland, discussed "New Markets and New Products." Patent protection for fixture designs, cost accounting, freight classification and other topics of interest to the manufacturers were reported on by committees.

OFFICERS ARE RE-ELECTED

All the officers of the association were re-elected as follows: President, Herman Plaut; vice-president, D. C. DeLancey; secretary, Charles H. Hofrichter; treasurer, B. F. Klein. Other members of the executive committee will be Albert Wahle, C. A. Bridges, P. I. Ansorge, Franz Brzeczkowski, William Horn, Robert Biddle, Albert Morreau and Edwin F. Guth. Edward M. Riddle was elected a member-at-large.

Talk on Carrier Current

Iowa Section, N.E.L.A., Evinces Much Interest in This and Other Timely Topics

AS WAS reported last week, electrical refrigeration was a leading topic of discussion at the convention of the Iowa Section, N. E. L. A., held in Fort Dodge on June 24-26. H. E. Young, sales manager Minneapolis General Electric Company, discussed it from two angles—present operation and future development. Mr. Young declared that this type of load was here to stay since more than forty thousand machines have been installed in the United States. He thought the volume of refrigerator business in the next two years would be the greatest outstanding development in the merchandising field.

G. M. Dwelley, sales manager Kelvinator Corporation, Detroit, told how some central-station companies had been selling electrical refrigeration for six years. He disputed the idea that the larger cities were the only places where these machines could be sold, maintaining that these companies could materially increase their refrigerating load in smaller places. Each refrigerator will earn annually per kilowatt of demand $213 as against $48 for a range and $10.80 for a vacuum cleaner, Mr. Dwelley said, but this device needs aggressive salesmanship and house-to-house campaigns.

E. G. Bryne, Frigidaire Corporation, Dayton, Ohio, stressed the point that sales and service must go hand in hand and that a demand must be created for this appliance before the volume of sales can be increased. He spoke on the value of the electrical refrigerator in controlling temperatures in a way no box filled with ice can do.

A frank talk on public relations from a newspaper publisher's viewpoint was made by E. P. Harrison, president Iowa Press Association. He felt that unless newspaper publicity goes the entire way in discussing utility service to the public the best of good-will relations cannot be obtained. Publicity, he asserted, should not be a bandage to cover troubles, but a social X-ray to reveal the entire utility story.

CARRIER CURRENT DISCUSSED

Carrier-current telephony aroused much interest when H. W. Deininger, Centerville, Iowa, told of his operating experience with a system controlling 130 miles of transmission lines. By paralleling the main line with a 1,100-ft. No. 4 stranded-copper antenna 4 ft. from it, he said, duplex operation was made possible through the use of two frequencies—3,700 meters for reception and 4,500 meters for transmission. Conversation was possible during severe lightning storms.

C. C. Jackson, Westinghouse Electric & Manufacturing Company, declared that these stations cost $5,000 on an average, depending primarily on the availability of high direct-current plate voltage. Broken conductors did not completely destroy communication because if the lines were grounded the earth served as a conductor. The high-frequency currents are induced in all three phases, thus increasing chances of maintaining communication if only one line is down. Open disconnecting switches appear to be the only item lowering effectiveness of communication.

Besides the new officers listed in the ELECTRICAL WORLD for June 28, page 1347, the following were appointed as members of the executive committee of the Iowa section: Austin Burt, Waterloo; George A. Lee, Omaha, Neb.; S. C. Dows, Cedar Rapids; C. N. Chubb, Davenport; C. A. Sears, Keokuk; C. A. Macy, Adel; M. G. Linn, Des Moines; E. F. Bulmahn, Centerville; H. Bellamy, Knoxville; H. C. Orton, McGregor, and F. J. Hanlon, Mason City. The total registration ran over three hundred.

Better Home Lighting Movement Forges Ahead

Reports from communities all over the United States and Canada indicate that the electrical interests are taking up whole-heartedly the movement for "better lighting in the home" which is being conducted by the Lighting Educational Committee under the direction of J. E. Davidson. Arthur Williams, general commercial manager New York Edison Company, has been added to the executive committee and will act as regional director for the eastern part of New York State. Many communities are taking the opportunity of building one or more of the fifteen-thousand-dollar model electric homes. Cleveland plans to build eight. A model of this home is being built by the National Art and Industry Exposition on Young's Million-Dollar Pier at Atlantic City through the co-operation of nine central-station companies, which include the Atlantic City Electric Company, Ohio Power Company, Ohio Service Company, Rockford Electric Company, Indiana-Michigan Electric Company, Kentucky-West Virginia Power Company, Scranton Electric Company, Indiana General Service Company and Wheeling Electric Company. A. C. Ekholm, exhibition director of the National Art and Industry Exposition, has charge of the construction of this home.

Substantial recognition of the home lighting campaign was given by the National Council of Lighting Fixture Manufacturers during its convention at Atlantic City, and official support was tendered by the executive committee of the National Association of Lighting Fixture Dealers. On July 9 J. F. Gilchrist, regional director of the Great Lakes Section, will present the plan before a meeting of about two hundred commercial managers, executives of jobbing houses, contractors and manufacturers at the Drake Hotel, Chicago. On the Pacific Coast the California Electrical Co-operative Campaign will handle the movement. A. Emory Wishon has been appointed regional director for California.

A plan for small cities has now been worked out in New York State and will be applied in Newburgh, Poughkeepsie, Beacon and Catskill in co-operation with the Hudson Valley Electrical Leagues. Local prizes will be given.

Milwaukee Contract Drawn

If Accepted, City Will Assume Partial Control of Utility Next Year with Purchase Option

A TENTATIVE contract in pursuance of negotiations long under way and previously noted in the ELECTRICAL WORLD has been drawn up by which the city of Milwaukee will assume partial control of the properties of the Milwaukee Electric Railway & Light Company on January 1, 1925, provided that the contract is sanctioned by the City Council and the Wisconsin Railroad Commission. The plan is to submit the contract to the people at the elections in November.

The contract consists of five articles and twenty-five sections, outstanding among them being provisions which give the city control over service and over extensions of service, subject to certain restrictions to insure that the company shall have a return of 7.7 per cent on its investment the first year. It embraces the transportation system, electric power, generating and distributing system and steam-heating system in the metropolitan district, together with leased property. It is understood that the value of the properties on January 1, 1925, has been placed at a figure somewhat in excess of $50,000,000, but this has not been placed before the committee for approval.

The city will have the right to purchase the property subject to the contract upon giving six months' written notice, but this becomes unenforceable so long as the city refuses to accept any substantial portion of such property on the ground that the purchase of such property is *ultra vires*. A city utility commissioner is provided whose salary is to be paid by the company.

Program of Ohio Electric Light Association

The thirtieth annual convention of the Ohio Electric Light Association will be held at the Breakers Hotel, Cedar Point, July 8 to 11, inclusive. The second day's program, under direction of the East Central Geographic Division, N. E. L. A., will include a report of the meter committee and a discussion of public relations by Martin J. Insull. Walter Cunningham, Huntington, W. Va., will discuss the recent developments in southern West Virginia and eastern Kentucky coal fields. Mrs. F. A. Tate of Louisville, Ky., will tell of women's work in the utility field, and Prof. C. O. Ruggles of the Ohio State University will read a paper on "Public Opinion and Utility Rate Making."

On Thursday a joint paper on "Spontaneous Combustion of Coal in Storage and Fusibility of Coal Ash" is to be presented by Henry W. Brooks, fuel engineer Bureau of Mines, Pittsburgh, and J. J. Dolan, Coshocton, Ohio, will report on the station operating committee's activities. R. R. Krammes, Canton, Ohio, will report on the activities of the transmission and distribution committee, and Henry Swift Ives, Chicago, will talk on the relationship of insurance and public utilities,

and Friday afternoon will be devoted to the election of officers, a report of the new business co-operations committee and a symposium entitled "Where Do We Go from Here?"

Wyoming Utility Men Have Successful Meeting

Not alone public relations but methods which will make the administration of utilities more effective received chief consideration at the annual convention of the Wyoming Utilities Association, held at Casper, June 23 and 24. The largest attendance in the history of the association was recorded. Co-operation and frankness with newspapers was stressed as part of the policy of improving relations with the public, and unless companies could live up to their advertising they were urged to remain passive.

Addresses were made by John A. Greenawalt, C. L. Titus and C. C. Johnson of the Mountain States Telephone Company, R. E. Richardson of the Lovell Gas & Electric Company and F. P. Firman of the Ohio Oil Company. George E. Lewis of the Rocky Mountain Committee on Public Utility Information spoke on "Un-educating the Public" and S. W. Bishop of the Denver Electrical League on "The Fifteen-Thousand-Dollar Essay Contest." Another address, given by C. A. Semrad of the Public Service Company of Colorado, Boulder, Col., was discussed by James A. Withrow, J. G. Keegan, M. H. Soule and George Rendleman.

E. P. Bacon, manager of the Natrona Power Company, retiring president, and H. C. Chappell, retiring secretary, were hosts to the convention and provided as part of the entertainment an 85-mile motor ride to the Salt Creek oil fields and Teapot Dome, which included an inspection of the new 25,000-kw. gas-engine plant now being built at Midwest.

The new officers elected were: President, C. L. Titus, Wyoming state manager Mountain States Telephone Company, Cheyenne; vice-president, James A. Potts, manager Rawlins Electric Light & Fuel Company; treasurer, R. E. Richardson, Lovell Gas & Electric Company. Charles St. John, Cheyenne, has been appointed secretary by president Titus.

St. Lawrence and Ottawa River Plans in Parliament

In the Canadian Senate at Ottawa on Thursday, June 19, Senator J. D. Reid moved a resolution asking that immediate action be taken by the government of Canada to negotiate with the United States for the development of the St. Lawrence waterway. He pointed out that this could not be an entirely Canadian project, as under a treaty with the United States that country had the same right in the use of Canadian canals and the St. Lawrence waterway as Canadians. He could not see why Canada should pay the cost of the development of the waterway and the United States have the same right of use. He felt that in the interest of Canada this channel should be immediately completed.

Senator Reid then traced the history of the negotiations between the two countries for joint action on this work. The report of the commission appointed in 1920 had been that it would cost $252,000,000 to build a 25-ft. waterway and develop 1,000,000 hp. The United States was agreeable to paying half the cost of the Welland Canal and would probably pay a share of the development already made on the St. Lawrence. If such agreement were reached, Canada's whole expenditure for the new undertaking would not be more than $75,000,000.

The Montreal Chamber of Commerce is opposing the international St. Lawrence project and favors an all-Canadian canal from Cardinal, on the St. Lawrence River, to Ottawa, thence following the Ottawa River to Montreal and tidewater.

Owing to the lateness of the present session of Parliament, it is unlikely that the Rankin bill providing for a five-hundred-million-dollar power development project on the lower reaches of the Ottawa River will be proceeded with this year. Under what circumstances the bill will be reintroduced next session remains to be seen, but concerted opposition from Ontario, almost regardless of party persuasion, has already been manifest.

New York-New Haven Electrification Complete

Announcement is made by the New York, New Haven & Hartford Railroad that the electrification of that line from New York to New Haven, Conn., is complete, delivery of the last of twelve electric passenger locomotives to the railroad by the Westinghouse companies and the Baldwin Locomotive Works having enabled the New Haven to abandon finally steam on this section of its road. Prior to the receipt of the twelve new electric locomotives it was the custom to change locomotives at Stamford for many of the through passenger trains, as well as for all the passenger trains which leave the main line at South Norwalk, Bridgeport and Devon, Conn. One of the results of the electrification is that the Colonial and Federal express trains are now handled by electricity from New Haven to Manhattan Transfer, near Newark, N. J., a distance of 84 miles.

Plans for electrification of this road began in 1903, and the first electrified service was given in 1907. Today the New Haven has 118 single-phase electric locomotives, as well as twenty-nine other electric locomotives, eight motor cars and sixty-eight trailers, all with multiple-unit control.

Government Development of Potomac

Real Question at Issue, the Embarkation of Nation in Water-Power Production, Ignored in Senate, Is Likely to Be Made Clear in House Committee

AS A RESULT of its hearings on the bill proposing the development by the government of the power resources of the Potomac River, the subcommittee of the committee on the District of Columbia of the House of Representatives received a liberal education on some of the difficulties which go hand in hand with water-power development. When the hearings began the sub-committee apparently expected to approve the Senate's action as quickly as it could comply with the formality of holding a hearing. As the hearing progressed, however, members began to realize that there was something in the contention that the Potomac could not be developed profitably under existing conditions and that it might be a mistake for the government to undertake the work even when conditions should become such as to make the project feasible. When the hearings were suspended, just prior to the adjournment of the session, the prospects were against the approval of the Senate bill by the District committee. The Senate had passed it without consideration or discussion, perhaps for consistency's sake, since it had passed the same bill at previous sessions.

Representatives of the Potomac Electric Power Company, which operates the large central station supplying Washington and its vicinity with electricity, pointed out to the committee that they naturally want to expand the business of their company. They realize that their company's interests are menaced to a certain extent by the possibility of the federal government taking over the development of the river. If there were any chance at all to undertake the development on a profitable basis, the company would jump at the opportunity, it is pointed out, rather than risk the possibility of having to compete with the government. The Potomac Electric Power Company is in a better position to handle the project than any other agency, public or private.

There is just one reason why the Potomac Electric Power Company does not undertake the Great Falls development, it was made clear to the committee, and that is because it is convinced that it can supply the needs of its territory for twenty years more at least at lower cost from its steam plant. It was maintained that the company has no fear that this development will be undertaken by other private interests. The calculation of costs and possible profit are relatively simple, and it was held that other private interests would reach the same result reached by the Potomac Electric Power Company.

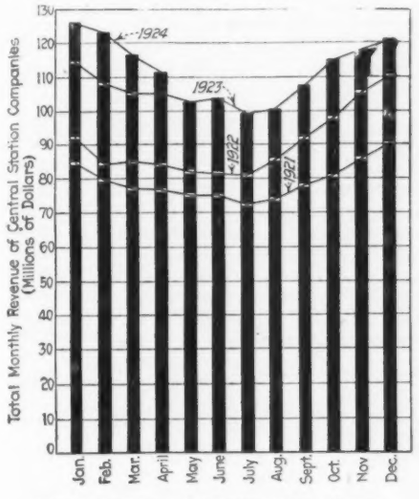
It is recognized generally that a public development is influenced by more than any saving which might be effected in the interest of the consumers in the District of Columbia or of the government itself. The government uses only a small percentage of the electric power consumed in the District. The real impetus behind the legislation comes from the advocates of public ownership and operation of such utilities. Senator Norris of Ne-

braska is the author of the bill. It was accepted by the Senate largely because of his tireless efforts. No conception of the real significance of the bill as an entering wedge for public control over water-power operations was brought home to the Senate. The House is alive to that situation. It is safe to say that before the measure comes to a final vote in the House—and that seems improbable for a long time to come—there will be a threshing out of the whole question of the federal government's policy with regard to public or private operation of hydro-electric projects

Financial and Corporate

Annual Growth of 11 per Cent in Revenue Indicated

Reports received by the ELECTRICAL WORLD from central-station companies representing approximately 75 per cent of the generator rating of the country indicate that the average daily gross revenue from the sale of energy during April totaled $111,400,000, or a daily



THE CENTRAL STATION HAS NEVER WITNESSED A DECREASE IN ANNUAL REVENUE

average of $3,710,000. This in an increase of 8.7 per cent over April, 1923. The total gross revenue for the first four months of the year totaled $479,-140,000 against $431,750,000 for the same period last year, a gain of 11 per cent. The operating expenses during April totaled $50,200,000, a gain of 11.3 per cent over April of last year.

The operating ratio, or ratio of operating expenses to the gross revenue, of companies having steam electric generating plants only, was 49.2 per cent during April, as against 49.8 per cent in April, 1923; 48.3 per cent in April, 1922; 53.9 per cent in April, 1921, and 56.5 per cent in April, 1920.

Swope Firm Believer in Stock Ownership by Employees

"We want our men to get the right picture of the General Electric Company," said President Gerard Swope, in a recent interview. "We want them to know that our company is not owned or controlled by 'capital,' but by some forty thousand investors in our stock. We want them to know that twelve thousand of the forty thousand are the company's own employees. We want them to know that more than 40 per cent of all our people who have been with the company more than a year are holders of its securities and that they own or have subscribed close to $15,-000,000 worth of bonds arranged specially for purchase on easy terms by employees and on which they get a return of 8 per cent. We want the men to know that those of us who are connected with the management are always more anxious to raise wages than to cut wages. But we want them to know that this can be done only if through the combined efforts of management and wage earners production can be increased and cost reduced."

As an indication of the interest of General Electric workers, Mr. Swope mentioned that last year more than 8,000 suggestions for improving methods of doing work were submitted. Of these 1,752 were adopted and a total of $23,000 in cash was awarded.

Utility Bonds for Savings Banks

Why Securities of Electric Light and Power Companies, Owing to the Nature of the Industry, Are Highly Desirable Investments

BY M. S. SLOAN
President Brooklyn Edison Company

THE electric light and power industry is a rapidly growing and essential business, singularly free from business depression, from labor disturbances and from loss of revenue. Utility bonds are more and more becoming favorite investments for our great insurance companies, for banks, trust companies, universities and colleges. In eight states the bonds of electric light and power companies are now legal investments for savings banks.

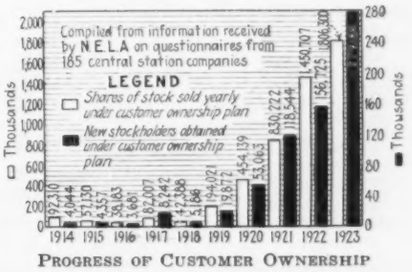
Electric public utilities believe that they are entitled to have their bonds legalized for savings-banks investments in other states also under proper restrictions. They desire it not only because it would be mutually advantageous, but because it would also be a recognition of merit. Public utilities are in need of large sums of money, and savings-bank officials have told me they hardly know what to do with their funds, which must be put to work with safety and assurance of prompt conversion when needed.

It seems to me that it would be for the best public interest to have a broadening of the investment field for savings banks legally brought about. This would result for the savings banks in a diversification of their investments with a yield sufficient to raise the average return on all their securities. For the utilities such a change in the law would open up additional channels of new capital with a tendency toward lowered rates for money, and this would eventually be reflected in the lessened cost of service to the ultimate consumer.

Being a monopoly furnishing an essential service, a public utility is regulated and supervised in the major phases of its operation by state officials whose duty is not only to assure the public against exploitation but also to assure the utility against exploitation. A public utility is not only responsible to the public for the conduct of its business, but it is also responsive to public opinion and diligently seeks a friendly public opinion because it deserves it.

An outstanding movement of the last ten years is the practice of utilities in selling preferred stocks to customers and employees on a deferred-payment plan. This practice is deservedly popular with the industry and with the public. It provides the former with a considerable amount of new capital and strengthens its financial structure by improving the position of its outstanding bonds. It makes new partners in the business, who take an interest in the affairs of public utilities and who constitute a force in public opinion tending to make certain that the utilities obtain a square deal.

Not only does this make the bonds of utilities more attractive for savings-banks investments, it adds to their safety and besides makes investors of people who might not otherwise become investors at all. There is thus developed a community of interest of priceless worth. Good securities of the first rank are made available to persons of small means, thrift is encouraged, and a formidable bulwark is


Compiled from information received by N E L A on questionnaires from 185 central station companies
LEGEND
Shares of stock sold yearly under customer ownership plan
New stockholders obtained under customer ownership plan
Thousands
Thousands
1914 1915 1916 1917 1918 1919 1920 1921 1922 1923

PROGRESS OF CUSTOMER OWNERSHIP

erected against socialism and communism, which in a democratic country like ours is a consummation devoutly to be wished. The public utilities are at one with the savings banks in insisting that only the very best first mortgage bonds that the industry affords shall be offered. We are just as anxious to

safeguard our own securities as savings banks are to guard the interests of their depositors. We recognize that there can be no free flow of capital without safety coupled with continuous earning power, and both of these the electric light and power industry affords.

Electric Light and Power Financing During June Breaks Record for 1924

ELECTRIC light and power securities amounting to $106,987,500 were offered by investment houses during the month of June, a total exceeding all monthly records for the current year as well as for the year 1923, with the exception of December, when the offerings of this type of security amounted to $119,446,000. The heavy financing during the past month has resulted in a total of $457,507,200 for the six-month period beginning in January, as compared with $397,051,600 for the same period last year. Forty individual issues brought out in June testify to the avidity with which investors are seeking and absorbing electric light and power securities. Long-term financing predominated, and the largest single issue was the twenty-million-dollar offering of mortgage bonds of the Puget Sound Power & Light Company at 96¾ and yielding 5.75.

The average rate of return dropped to 6.09 per cent, which is the lowest point reached this year. Five of the issues were offered at 5 per cent, and in only two cases was an 8 per cent return offered.

SECURITY ISSUES OF ELECTRIC SERVICE COMPANIES IN JUNE

Name of Company	Amount of Issue	Period, Years	Class	Purpose	Interest Rate	Price	Per Cent Yield
Georgia Railway & Power Co.	$3,000,000	30	General mortgage gold bonds	Additions and improvements	6	98	6.15
Tennessee Electric Power Co.	1,000,000	15	Sinking-fund debentures	Property expenditures and to increase working capital	6½	97	6.80
Adirondack Power & Light Corp.	5,000,000	5	Convertible debentures	Corporate purposes	6	99½	6.20
	925,000	26	First and refunding mortgage gold bonds	To liquidate floating debt incurred for additional property	6	100	6
California-Oregon Power Co. (Cal.)	2,500,000	18	First and refunding mortgage sinking-fund gold bonds, series B	Construction and to reimburse for capital expenditures	6	99½	6.05
Central Power Co. (Del.)	1,500,000	20	First mortgage gold bonds, series C	Refunding and additions	6	94	6.55
Oklahoma Gas & Electric Co.	2,000,000	17	First and refunding mortgage gold bonds, series B	Additions	6	93½	6.65
Baton Rouge Electric Co.	1,000,000	30	First mortgage gold bonds, series A	Refunding and construction	5½	93	
Puget Sound Power & Light Co.	20,000,000	25	First and refunding mortgage gold bonds, series A	Refunding and to reimburse for expenditures on additions	5½	96¾	5.75
American Public Service Co. (Ill.)	625,000	18	First lien gold bonds	To provide working capital	6	94½	6.50
California-Oregon Power Co.	1,500,000	20	Sinking fund convertible gold debentures	Construction and to reimburse for capital expenditures	7	100	7
Eastern New Jersey Power Co.	1,250,000	..	Cumulative participating preferred stock	To defray cost of consolidation of properties	7	92½	7.57
Minnesota Power & Light Co.	4,000,000	26	First and refunding mortgage gold bonds	Acquisition of new properties	6	100	6
New Hampshire Power Co.	250,000	..	Cumulative preferred stock, series A	To reimburse for cost of recently acquired properties, for additions and for other corporate purposes	8	100	8
Northern Ohio Traction & Light Co.	1,250,000	2	General and refunding mortgage gold bonds	Additions	6	99	6.54
Tidewater Power Co. (N. C.)	1,070,500	18	First lien and refunding mortgage gold bonds, series A, sinking fund	Additions	6	97½	6.20
Jersey Central Power & Light Corp.	1,250,000	2	Secured gold notes	To secure capital stock of other companies	6½	99	6.90
Kentucky Hydro-Electric Co.	4,000,000	25	First mortgage gold bonds, series A	To reimburse for expenditures already made and for construction purposes	6	94	6.50
Nebraska Power Co.	1,000,000	25	First mortgage gold bonds, series A	Additions	5	95	5.37
North Counties Hydro-Electric Co. (Ill.)	500,000	20	First (closed) mortgage sinking fund gold bonds	Construction	6½	99	6.60
Northern Ontario Light & Power Co., Ltd.	500,000	7	First mortgage sinking fund gold bonds	Construction purposes and to reimburse for expenditures on additions	6	94½	7
Potomac Edison Co. (Md.)	1,000,000	26	First mortgage and refunding gold bonds, series C	Construction	6	95	6.40
Southwestern Power & Light Co. (Tex.)	2,000,000	..	Cumulative preferred stock	Refunding and for other corporate purposes	7	96½	7.25
Texas Power & Light Co.	1,500,000	13	First mortgage gold bonds	Construction	5	95	5.55
Arkansas Central Power Co.	1,000,000	24	First lien and refunding mortgage gold bonds	Additions	6	100	6
El Paso Electric Co. (Tex.)	800,000	1	Gold notes, series B	To reimburse for expenditures made and to be made	5	100	5
Washington Railway & Electric Co. (D. C.)	2,469,000	10	General and refunding mortgage gold bonds	Refunding and for additions	6	99	6.13
Appalachian Power Co. (W. Va.)	4,000,000	100	Gold debentures, series A	To finance company's interest in purchase of stock of another company, etc.	6	87½	6.85
Central Illinois Light Co.	933,000	19	First and refunding (now first) mortgage gold bonds	To reimburse for expenditures on extensions	5	94½	5.47
General Gas & Electric Corp. (N. Y.)	1,040,000	..	Cumulative preferred stock, class A, participating and noncallable	Proceeds to be used for additional investment in subsidiaries	8	104	7.70
Kentucky Utilities Co.	4,500,000	25	First mortgage lien gold bonds, series E	Refunding and other corporate purposes	6	96	6.50
Otter Tail Power Co. (Minn.)	175,000	15	General mortgage and refunding gold bonds, series C	To reimburse company for purchase of new properties and for other capital expenditures	6½	99½	6.55
Power Corporation of New York	2,000,000	..	Cumulative preferred stock (common-stock warrants attached)	To furnish a portion of purchase price of stock of Northern New York Utilities	7	96	7.25
Red River Valley Power Co. (Minn.)	700,000	20	First mortgage gold bonds, series A	To reimburse the company for cost of consolidation	6½	100	6½
St. Paul Gas Light Co. (Minn.)	2,650,000	30	General and refunding mortgage gold bonds, series B	To reimburse for expenditures on additions and for other corporate purposes	5½	97	5.70
Pennsylvania-Ohio Power & Light Co.	19,000,000	30	First and refunding mortgage gold bonds, series A	Refunding and additions	5½	98	5.65
	2,700,000	15	Gold debentures		6	97½	6.25
Utica Gas & Electric Co.	3,300,000	25	General mortgage gold bonds, series C	Construction	5½	100	5½
Staten Island Edison Corporation	1,600,000	40	Refunding and improvement mortgage gold bonds, series B	Additions and other corporate purposes	6	98½	6.10
City of Seattle (Wash.) (municipal light and power plant and system)	1,500,000	6–20*	Gold bonds	Additions	5	100	5
Total	$106,987,500						

* Due serially.

Holtwood Power Company Has Been Organized

The company formed recently by interests identified with the Pennsylvania Water & Power Company, as was announced in the May 31 issue of the ELECTRICAL WORLD, to build a power plant at Holtwood, Pa., has been organized as the Holtwood Power Company. It will have $1,500,000 stock and $25,000,000 first mortgage thirty-year 6 per cent bonds, $2,750,000 of which were offered during the past week at 99 and interest to yield over 6 per cent. The new plant will adjoin the plant of the Pennsylvania Water & Power Company now existing at Holtwood and will be connected with lines serving the Consolidated Gas, Electric Light & Power Company of Baltimore. J. E. Aldred, chairman of the Pennsylvania Water & Power Company and the Baltimore company, will also head the board of the Holtwood company, and C. E. F. Clarke, president of the Pennsylvania Water & Power Company, will be the Holtwood company's chief executive.

Stockholders' Privilege to Subscribe

Stockholders of the Public Service Company of Northern Illinois of record July 3 are to have the privilege of subscribing to the company's new 7 per cent cumulative preferred stock, which is being offered at $100 per share on the ratio of one share of new stock to each five shares held. Both common and preferred stockholders are entitled to the right to subscribe and on the same basis, subscriptions to be taken only until August 1. Stockholders are to be given the opportunity to subscribe either for cash, on a quarterly payment plan or on a monthly payment plan.

Excellent Reports of Earnings Make Utility Securities Stronger Still

THE economic position of electric light and power securities bears a certain resemblance to that of father in the home—their stability, safety and earning power are not fully appreciated until general business conditions are on the down grade. During the past few weeks the strength of utility stocks has been the real feature of the securities market. Some of the advances made border on the sensational, and the whole group has moved up in a most impressive fashion.

The accompanying tabulation gives the average price of twenty-nine electric light and power stocks as on January 1 and June 21, 1924. The average price at the first of the year was 55 as compared with 72 on June 21, an increase of 17 points or 31 per cent. It will be noted that while the seasoned and stable stocks have shown increases, it is the more speculative stocks which have had a phenomenal rise. Several have had increases of 100 per cent, and in one case the increase has been 280 per cent.

It should not be forgotten, however, that during this six months' period the public utility bond market has also been very active and strong; in fact, the increase, especially in seasoned securities, has been greater in the case of public utility bonds than in the case of public utility stocks.

It is the story of 1921 repeated. It is the story of splendid earning records at a time when industry in general is suffering a reaction and when the future is at best uncertain. It is the story of an industry which has never reported a decrease in annual income under any previous year and whose ability always to meet its obligations to security holders can never be questioned. Investors remember these things when the storms approach and naturally conclude that the conservative thing to do is to place investment funds in electric light and power securities. The decided upward movement of utility stocks and bonds is based not on sentiment, but upon sound facts.

AVERAGE PRICES OF TWENTY-THREE PUBLIC UTILITY STOCKS (INCLUDING THE SEVEN MOST REPRESENTATIVE ELECTRIC LIGHT AND POWER STOCKS), SHOWING THE GREATEST INCREASE IN PRICE DURING THE FIRST SIX MONTHS OF 1924.

Utility	Price		Increase	
	January 2	Week Ended June 21	Amount	Per Cent
Average of seven representative companies	113.10	114.94	1.84	...
Adirondack Power & Light	19⅞	34½	14⅝	73.5
American Gas & Electric	43	70¼	27¼	63.5
American Public Utilities	29	60	31	107
American Water Works & Electric	41⅛	88⅛	47	113
Arkansas Light & Power	22	31	9	41
Central States Electric	20	37	17	85
Colorado Power	21	33	12	57
Commonwealth Power	54	94	40	74
Federal Light & Traction	70	80	10	14.3
General Gas & Electric	15⅛	58	42⅞	280
Illinois Traction	59	95	36	61
Kentucky Securities	43	70	27	63
Lehigh Power Securities	29⅜	72	62½	21
National Light, Heat & Power	5	11	6	120
Portland Electric Power Co.	19	37	18	95
Public Utilities of Nova Scotia	43½	53	9⅝	22.8
Puget Sound Power & Light	43	51	8	18.6
Republic Railway & Light	15	26½	11½	76.5
Tennessee Electric Power	15⅛	39	23⅞	148
United Light & Railways	135	150	15	11.1
Utah Securities	17⅛	29⅞	12⅞	74.5
West Penn	47	69⅜	22⅜	47.5
Averages	55	72	17	31

Stock and Bond Quotations of 200 Companies

Beginning with the next issue of the ELECTRICAL WORLD, there will be published weekly a list of stock and bond quotations of two hundred outstanding electric light and power and electrical manufacturing companies, covering the high and low prices of the year and the current price of these securities.

Dividends Declared

The following quarterly dividends were announced by central-station companies and electrical manufacturing companies during the seven-day period ended July 1:

Name of Company	Per Cent	When Payable
Adirondack Pr. & Lt. 7% pf.	1¾	July 1
Am. Wtr. Wks. & El. 7% 1st. pf.	1¾	Aug. 15
Arkansas Light & Power pf.	1¾	July 1
California-Oregon Power pf.	1¾	July 30
Eastern Texas Electric com.	1½	July 1
Edison Electric, Lancaster	3	June 30
Fall River Electric	2	July 1
Florida Public Service pf.	1¾	July 1
Harrisburg Light & Power pf.	1¾	June 30
Louisville G. & E. of Kentucky pf.	1¾	July 15
Minnesota Pwr. & Lt. 6% pf.	1½	July 1
Nevada-California Electric pf.	1¾	Aug. 1
Northern States Power com.	2	Aug. 1
Public Service of Oklahoma com.	2	June 30
Public Service of Okla. prior lien	1¾	June 30
Public Service of Oklahoma pf.	1¾	June 30
Sandusky Gas & Electric pf.	1¾	July 1
Sayre Electric pf.	1¾	July 1
Toledo-Edison pf.*	58⅓c.	July 1
Washington Water Power	2	July 15
West Penn Co. 7% pf.	1¾	Aug. 15
West Penn Power 7% pf.	1¾	Aug. 1
Western Power pf.	1¾	July 15
Allis-Chalmers Mfg. com.	$1	Aug. 15
Johns-Manville, Inc.	75 c.	July 1
Wagner Electric pf.	1¾	July 1

* Monthly.

Company Reports

Among the company financial reports issued during the past week for the month of May are the following:

Name of Company	Gross Revenue for May	
	1924	1923
Alabama Power	$699,600	$631,022
Asheville Power & Light	84,658	78,252
Bangor Railway & Electric	118,920	114,462
Carolina Power & Light	191,158	176,139
Colorado Power	113,414	99,297
Columbia Gas & Electric	1,782,403	1,596,042
Commonwealth Power	2,503,880	2,308,546
Consumers' Power	1,477,673	1,304,271
Cumberland County Power & Light	284,808	288,173
Georgia Railway & Power	1,284,688	1,323,747
Great Western Power	636,829	562,483
Kansas City Power & Light	751,662	694,267
Niagara, Lockport & Ontario Power	457,642	443,826
Northern Ohio Electric	844,528	866,802
Portland Electric Power	895,144	907,721
Republic Railway & Light	879,278	779,668
Tennessee Electric Power	778,691	735,177
United Gas & Electric	547,250	508,958
Utah Power & Light	694,693	644,637
Virginia Railway & Power	858,611	850,198
Yadkin River Power	134,291	161,189

Edison Electric Illuminating Company of Brockton.—The stockholders of the Edison Electric Illuminating Company of Brockton will vote on July 9 on changing the par value of the stock from $100 to $25 per share. The decision is subject to the approval of the Massachusetts Department of Public Utilities.

American Gas & Electric Deal Consummated.—Negotiations for the sale of the Binghamton Light, Heat & Power Company to the American Gas

& Electric Company, which were reported in last week's issue of the ELECTRICAL WORLD, have been completed, according to W. S. Barstow & Company, who were the owners of the Binghamton company. The sale included also the Sayre (Pa.) Electric Company.

Capital Stock Increase.—The Adirondack Power & Light Corporation, Schenectady, N. Y., has increased its capital stock from $25,000,000 to $30,000,000. The class of stock covered by this increase is the 7 per cent cumulative preferred.

Increased Dividend. — The Eastern Texas Electric Company, Beaumont and Port Arthur, Tex., has declared a dividend of $1.25 a share on the $50 par value common stock, compared with a previous dividend of $2.25 a share on $100 par stock. At the same time the regular semi-annual dividend of $3.50 a share was declared on the preferred stock.

Baton Rouge Company Calls Bonds.—All of the outstanding first mortgage 5 per cent thirty-year gold bonds of the company, due February 1, 1939, have been called for payment on August 1 at 105 and interest. It was partly for the purpose of retiring this debt that the company offered during the past month a million-dollar issue of gold bonds.

Pacific Gas & Electric Files Stock Application.—The Pacific Gas & Electric Company has applied to the California Railroad Commission for authority to issue $5,000,000 common stock at not less than $92 per share. The purpose of the issue is to raise funds to meet the cost of improvements on Mount Shasta power projects and at other places.

Northern States Power Plans New Issue.—Stockholders of the Northern States Power Company have been called to a meeting to be held on July 10 for the purpose of authorizing a new class of stock to be known as class B common. Ten million shares are sought for authorization, but only 500,000 will be issued, the remainder being held for future requirements.

Meeting to Change Par of Stock.—The Electric Light & Power Company of Abington and Rockland, North Abington, Mass., has called a special meeting of its shareholders for July 11 to vote on changing the par of the stock from $100 to $25 and on issuing four new shares for one of the old. This change does not affect the capital, which amounts to $453,000.

Black & Decker Pay Dividends.—On June 19 the board of directors of the Black & Decker Manufacturing Company, Towson, Md., held their regular quarterly meeting for the second quarter of 1924. The usual 2 per cent dividend on preferred stock as well as a 2 per cent dividend on common stock was declared. It is interesting to note that in addition to maintaining the payments of the preferred dividends the company has also paid at the rate of 8 per cent on its common stock.

Briefer News

Atlanta A. I. E. E. Elects Officers.—The annual election of officers of the Atlanta Section of the American Institute of Electrical Engineers resulted as follows: Chairman, Rawson Collier; vice-chairman, F. B. Davenport; secretary and treasurer, H. N. Pye; executive committee, G. J. Yundt and W. W. Ballew.

Eight-Million-Dollar Hydro and Irrigation Project.—The Pacific Gas & Electric Company and the Nevada (Cal.) Irrigation District have concluded eighteen months' negotiations for a joint hydro-electric and irrigation development in Nevada and Placer Counties which will cost about $8,000,000, and joint application for approval has been made to the California Railroad Commission.

Northern States Company Establishes Experimental Rural Line in South Dakota.—The Northern States Power Company has established a "laboratory line" through a rural district near Sioux Falls, S. D. The line is about 9 miles long, and seventeen farmers are using the service. A fixed charge amounting to about $7 a month for each consumer has been established. In addition the farmers pay a service charge of 5 cents per kilowatt-hour for the first 30 kw.-hr. and 3 cents for all electricity used in excess of that. The results are being checked up to determine how the farmers can use electricity most profitably.

International Mathematical Congress.—The International Mathematical Congress will be held at Toronto on August 11 to 16, under the auspices of the Royal Canadian Institute and the University of Toronto. This is the first meeting of the congress to be held on the American Continent, and special prominence will be given to engineering and other practical applications of mathematics, contributions having been invited from physicists and engineers engaged in mathematical invesigations of engineering problems. Additional information may be obtained from Prof. J. K. Synge, Royal Canadian Institute, Toronto, Canada.

British Association to Meet in Toronto.—The ninety-second annual meeting of the British Association for the Advancement of Science will be held in Toronto from August 6 to August 13, almost concurrently with the international mathematics congress which will convene from August 11 to August 16. Among electrophysical papers to be presented at the British Association meeting are "Critical Potentials and Their Interpretation," by F. L. Mohler and P. D. Foote, and "Electric Discharges in Mercury Vapor and in Argon," by Irving Langmuir. Sir William H. Bragg, the president of the mathematical and physical section of the association, is a leading authority on radio activity and crystal structure.

Loveland, Col., Condemns Power Plant.—The City Council of Loveland, Col., has passed an ordinance condemning the power plant of the Public Service Company of Colorado unless the company accepts the city's bid of $57,000. This is another step in the movement for a municipal plant already reported in these columns. The Public Service Company's plant was formerly appraised at $157,000.

Tacoma Pushes Lake Cushman Plant.—A contract for the excavation and construction of the foundation of the first unit power house of the Lake Cushman hydro-electric plant undertaken by the city of Tacoma, Wash., has been awarded to A. Guthrie & Company on a bid of $118,425. As stated in the ELECTRICAL WORLD for April 19, page 798, the same firm is building the storage dam, to form a lake 10 miles long, on a bid of $886,148.

Quebec Power Company to Supply Energy to Docks.—An important contract has been signed between the Quebec Harbor Commission and the Quebec Power Company for the latter to supply the commission with several thousand horsepower for the purpose of operating all the Harbor Commission's activities on the Louise Docks. The energy will be utilized for the operation of all motors at Louise Basin. These include the grain elevator, machine shops, lighting system and other works.

Virginian Power Company to Build New Line and Plant.—The Virginian Power Company will construct a power line from Cabin Creek to Portsmouth, Ohio, through Charleston and Huntington, W. Va., at a cost of about $1,500,000 this summer. This new line will carry from 132,000 volts to 200,000 volts, supplementing the present 44,000-volt line from the Cabin Creek hydro-electric plant to Huntington. The Virginian Power Company, it is announced, has completed purchase for $3,500,000 of the plant and franchises of the Portsmouth Public Service Company, which furnishes power in Portsmouth, and will build a hydro-electric power plant of 150,000 kw. capacity at Hinton, W. Va. The properties are being financed and operated by the Cities Service Company.

Suit Over Payment for Alterations in Engineering Specifications. — A suit of interest to hydro-electric companies and to engineers undertaking hydraulic construction has been filed in the Circuit Court at Chippewa Falls, Wis., by the James O. Heyworth Company of Chicago and St. Paul, builder of the Jim Falls hydro-electric power plant, against the Chippewa Power Company, the Northern States Power Company and others to foreclose a lien claim of $138,846 said to be due for work done on the dam and power house under an alleged oral agreement authorizing constructional alterations in the original plans and specifications. The Heyworth company claims that owing to incompleteness of plans and specifications provided by the power company no contracting firm could have fulfilled the contract without alterations. The defendant companies dispute the claim.

Narragansett Company to Burn Pulverized Coal.—The contract noted under "Activities of the Trade" last week by which the Narragansett Electric Lighting Company of Providence, R. I., will install new boilers rated at 7,100 hp. will increase the generating capacity of the South Street station of that company by about 50 per cent, besides marking a departure in the practice of the company, which of recent years has used fuel oil under its boilers almost exclusively, thereby causing Rhode Island to rank third after California and Texas among states burning oil to produce energy.

Electrical Equipment of Des Moines' Big New Office Building.—Containing more than a hundred miles of electric wire of all sizes, 35 miles of metal conduit and more than ten thousand sockets and outlets, with a substation of the Des Moines Electric Company in the basement, and with equipment for physicians, dentists and others needing special apparatus, the new Equitable Building in Des Moines, Iowa, has aroused pride in that city because of its complete electrification as well as for its size. The ventilation system, the clock and signal system, the pumps and various labor-saving devices are electrically operated, and ice water is circulated through the building by electric power. Forty big lamps with the latest type of reflectors provide the floodlights which play on the tower.

"Largest Electric Ship" Under Construction at Cramp Yards.—A contract for electric propulsion equipment on the Matson liner to be built by the Cramp Shipbuilding Company has been awarded to the General Electric Company. The Matson liner will, it is said, be the largest electrically propelled passenger ship in service. The equipment will consist of two Curtis steam turbines directly connected to two 12,000-hp. alternating-current generators, which will supply electricity to operate two 10,000-hp. synchronous motors, each connected with a propeller shaft. Plans for the new liner call for a speed of 21 knots, which will enable the vessel to make a round trip between San Francisco and Honolulu every fourteen days, including two and a half days in each port. This compares with the present schedule of twenty-eight days.

Status of Superior (Wis.) Central-Station Plant.—The endeavor of the city of Superior, Wis., to take over the electric and gas plants operated by the Superior Water, Light & Power Company has been brought to a close for the time being at least by a decision in favor of the company rendered in an equity suit in the United States District Court. This decision restrains the city from asserting title or interest in the electric and gas plants and from claiming any right to possession, earning or control thereof under orders of the Wisconsin Railroad Commission. The decision sets aside the order of the commission dated March 19, 1923, giving compensation to the company and title to the electric and gas plants to the city and also provides that the commission and the city be permanently enjoined from attempting to enforce it. The commission, however, does not lose jurisdiction to proceed further to determine the just compensation to be paid by the city for the properties if the city decides to renew proceedings for their acquisition.

Ten Thousand Dollars for Electric Vehicle Campaign. — Of the $12,500 which it was anticipated would be forthcoming from electric vehicle manufacturers to carry forward the educational campaign of the Society for Electrical Development, $10,550 has already been subscribed by the following companies: Autocar, C-T, Kelland, Steinmetz, Walker, Ward, Edison Storage Battery, Electric Storage Battery, General Electric, Sangamo Electric and Westinghouse. The other manufacturers of trucks, batteries and accessories are expected to subscribe to this program, so that it will represent 100 per cent participation of those interested and those who will receive the benefits of this co-operative business-building activity.

Increased Rates to Southern California Edison Deferred.—Hearing on the application of the Southern California Edison Company for an increase of approximately 20 per cent in rates for electricity, which the company hoped to make effective on July 1, has been deferred by the California Railroad Commission because of protests from consumers. A hearing has been set for the middle of July, and if the increase is granted, it will probably go into effect August 1. The company asks the increase for a nine-month period only, to take care of the great expense entailed on it by the conditions arising from the drought. Postponement of the date when the emergency rates goes into effect will, the company says, make it necessary to retain it until a correspondingly later date.

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations is published on the last page of this issue.]

Ohio Electric Light Association—Hotel Breakers, Cedar Point, Ohio, July 8-11. D. L. Gaskill, Greenville, Ohio.

East Central Division, N. E. L. A.—Cedar Point, Ohio, July 9. L. B. Herrington, Kentucky Utilities Co., Louisville.

Mississippi Electrical League—Gulfport, Miss., July 14-15.

Pacific Coast Electrical Supply Jobbers' Association—Del Monte, Cal., July 24-26.

Pennsylvania Electric Association—Bedford Springs Hotel, Bedford Springs, Pa., Sept. 3-6. H. M. Stine, 212 Locust St., Harrisburg.

Association of Edison Illuminating Companies—Griswold Hotel, New London, Conn., Sept. 8-12. P. S. Millar, 80th St. and East End Ave., New York.

Michigan Electric Light Association—Detroit, Sept. 9-11. Herbert Silvester, Edison Bldg., Ann Arbor, Mich.

New England Division, N. E. L. A.—Hotel Wentworth, Portsmouth, N. H., Sept. 10-13. Miss O. A. Bursiel, 149 Tremont St., Boston.

Rocky Mountain Division, N. E. L. A.—Hotel Colorado, Glenwood Springs, Col., Sept. 15-17. O. A. Weller, 900 15th St., Denver.

Southeastern Division, N. E. L. A.—Birmingham, Sept. 15-18. E. T. O'Connell, Alabama Power Co., Birmingham.

Great Lakes Division, N. E. L. A.—French Lick, Ind., Sept. 24-27. R. V. Prather, Illinois Mine Workers' Bldg., Springfield, Ill.

To Experiment with Salmon Pond at Projected Baker River Dam.—A protest filed by the United States Bureau of Fisheries against the proposed hydro-electric plant on Baker River, Wash., has, it is announced, been withdrawn, on the promise of Stone & Webster, who are to erect the plant, to construct a pond below the dam where the bureau can place adult salmon taken while on their way to the spawning grounds on Baker Lake and determine whether a hatchery can successfully be maintained at the artificial pond. A fish ladder to enable the salmon to ascend the obstruction has been held to be impracticable.

Boston Edison Begins to Enlarge General Service Plant. — The Edison Electric Illuminating Company of Boston has just begun construction of a new general stock building, to cost with equipment $450,000 This undertaking marks the initiation of a comprehensive program of expansion and redevelopment at the general service buildings of the company on Massachusetts Avenue. The company's requirements for the next decade have been analyzed in studying the developments proposed. The first building is to contain a section for document storage in addition to general stock uses. As now erected it will be 110 ft. wide by 194 ft. long, but later it will be extended to about twice this size. The storage building will be of concrete and two stories high, having provision for an industrial track and electric cranes of sufficient capacity to handle a 5,000-kw. oil-cooled transformer. A railroad connection will be included, and an important feature will be the inauguration of a scheme for the centralized storage and handling of electrical appliances for the company's numerous retail stores. Increased shop facilities and garages are also contemplated in the ten-year program the company has adopted.

Utility Men Will Speak at London Advertising Convention.—Discussion of public utility advertising will be one of the features of the international convention of the Associated Advertising Clubs of the World in London in July. The program just made public by Frank L. Blanchard, director of public relations, Henry L. Doherty & Company, and chairman of the London program committee of the Public Utilities Advertising Association, shows four American and four British speakers listed. The subjects of the American papers and their authors will be: "Municipal Versus Private Ownership of Public Utilities," by B. J. Mullaney, People's Gaslight & Coke Company, Chicago; "How to Win Good Will for the Company," P. L. Thompson, Western Electric Company, New York; "Progress of Customer Ownership in the Sale of Shares," Frank L. Blanchard, and "Legal Aspects of Public Utility Advertising," by a speaker yet to be selected. The subjects of the British papers will be "Company Ownership and Operation Under Public Control," "Co-operative Advertising of a Public Utility," "The Personal Element in Advertising" and "Railway Advertising." All the addresses will be made at a one-day session and luncheon which will be held on July 16.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in All Branches of the Electrical Industry

A. B. Huey New Senior Vice-President in Philadelphia

Arthur Baird Huey, who has been elected senior vice-president of the Philadelphia Electric Company, as was announced in the June 28 issue of the ELECTRICAL WORLD, is by training and profession a lawyer. Born in Philadelphia on June 24, 1870, he was educated at the Hamilton School of that city, later entering the law school of the University of Pennsylvania, from which he was graduated in 1895. He practiced his profession and became attorney for the Philadelphia Electric Company late in 1901. Mr. Huey has been a vice-president of the company since 1922, when he was promoted to that office and placed in charge of the legal department. As senior vice-president he is succeeding Walter H. Johnson, who in turn succeeds as president Joseph B. McCall, who has become chairman of the board of directors.

A. B. HUEY

C. G. Clough, who has been statistician on the Wisconsin Tax Commission, has been appointed public utilities statistician of that body, succeeding E. J. Brabant, recently resigned.

Frank S. Wright, who has been identified with the sales department of the Fitchburg (Mass.) Gas & Electric Light Company, has been appointed sales manager of the Beverly (Mass.) Gas & Electric Company. These properties are under the management of Charles H. Tenney & Company.

Dr. L. H. Baekeland of Yonkers, N. Y., president of the American Chemical Society and honorary professor of chemical engineering in Columbia University, has recently been horored by King Albert of Belgium, who made him a Commander of the Order of Leopold. Dr. Baekeland's scientific achievements have won wide recognition in this country and abroad in the form of medals and other awards. Dr. Baekeland is the inventor of bakelite and at the present time is president of the General Bakelite Company.

J. A. Reich, formerly connected with the El Paso (Tex.) Electric Railway Company, has been transferred to the Ponce (P. R.) Electric Company as chief engineer, succeeding Thomas E. Crossan, who recently left for Pensacola, Fla. The Porto Rican utility as well as those in the United States is a subsidiary of Stone & Webster.

Lester L. Ring, statistician for the Federal Light & Traction Company, New York, sailed for Europe on July 2 on the liner *Paris*. Mr. Ring is planning to make an extended trip abroad, which will include a visit to the British Empire Exposition at Wembley. During his travels he will direct his attention especially to power production and transmission.

C. W. Platt has been appointed secretary of the Pacific Power & Light Company and of the Portland Gas & Coke Company, both at Portland, Ore., succeeding the late George F. Nevins. Mr. Platt became identified with the gas and coke company in 1909 as chief bookkeeper, advancing three years later to the position of assistant secretary and treasurer. He held this office until his recent promotion.

R. A. Chattock, city electrical engineer of Birmingham, England; **G. G. Bell**, borough electrical engineer of Hammersmith; **David Wilson**, **G. C. Usher** and other British engineers recently returned to England from a visit of inspection of superpower stations in the United States and Canada. The tour of three thousand miles included visits to the Hell Gate station and Sherman Creek station in New York, the Colfax station of the Duquesne Light Company, Pittsburgh, the Springdale station of the West Penn Power Company, the Cahokia plant of the Union Electric Light & Power Company of St. Louis and other big plants.

H. D. Randall, district manager for the Rocky Mountain territory of the General Electric Company, with headquarters in Denver, and for more than a year chairman of the manufacturers' division of the electrical industry in that city, has been elected chairman of the Electrical Co-operative League of Denver for the ensuing twelve months. He succeeds O. L. Mackell, whose term of office expired July 1. Mr. Randall, a member of the directing board of the Denver League since the founding of the organization, went to Denver from Salt Lake City, where he was local manager of the General Electric organization. He still holds the office of chairman of the board of directors of the Capitol Electric Company of that city and also is chairman of the board of directors of the Butte (Mont.) Electric Supply Company. He is actively identified with a number of technical organizations, including the National Electric Light Association, American Institute of Electrical Engineers and the American Electrochemical Society.

F. M. Feiker, formerly of the McGraw-Hill Company, Inc., and now a vice-president of the Society for Electrical Development, has been designated by Secretary of Commerce Hoover to make an intensive study of British advertising methods with the purpose of enabling the American producer to advertise his goods properly to the British consumer. Mr. Feiker sailed from New York on July 2. He will visit the industrial centers of England to collect material which will enable the American advertiser to present his wares successfully to the British consumer in competition with the merchants of other countries.

F. A. Leach New President of Pacific Association

Frank A. Leach, Jr., who was recently elected president of the Pacific Coast Electrical Association, as was announced in the June 21 issue of the ELECTRICAL WORLD, has been identified with the public utility industry in California for the past twenty-six years. He entered upon his career in the electrical field as an employee of the Oakland Gas, Light & Heat Company when the late John A. Britton was its president and general manager. Subsequently Mr. Britton was called to the presidency of the California Gas & Electric Corporation, of which the Oakland company was a subsidiary, and Mr. Leach was appointed to succeed him as manager of the Oakland company and also of the Berkeley Electric Lighting Company. The Pacific Gas & Electric Company was organized in 1905, Mr. Leach assuming at that time the duties of manager of the East Bay division. The year 1920 found him in the company's head office in San Francisco acting as vice-president in charge of public relations and service, and last year when the sudden death of his old associate, John A.

F. A. LEACH

Britton, left the office of general manager vacant he was selected to fill the place Mr. Leach has taken a prominent part in the activities of engineering organizations on the Coast, including the National Electric Light Association, the Illuminating Engineering Society and the Engineers' Club of San Francisco.

Sloan New Head of Public Relations National Section

Matthew S. Sloan, recently appointed chairman of the Public Relations National Section of the National Electric Light Association by President-elect Franklin T. Griffith, as was announced in the June 28 issue of the ELECTRICAL WORLD, has been associated with electrical companies in the South and East since his graduation from the Alabama Polytechnic Institute in 1901. After a short connection with the General Electric Company he entered the utility field as chief engineer of the Birmingham Railway, Light & Power Company, subsequently being made assistant superintendent of the lighting and power departments, and in 1907 he was appointed superintendent of power. Another promotion followed in 1908, when he became superintendent of the company's electric department in charge of the operation and commercial sales of that department. In 1910 he was made assistant to the president with supervision over all departments. He affiliated himself with the New Orleans Railway & Light Company as assistant to the vice-president in 1913, later was made manager of the railway and electrical departments, and in 1917 became vice-president and general manager.

Not long after this Mr. Sloan resigned to join the New York Edison

M. S. SLOAN

Company as assistant to Vice-president John W. Lieb and in that capacity became operating manager. When Nicholas F. Brady resigned as president of the Brooklyn Edison Company in 1919 Mr. Sloan was appointed to succeed him, and since that time he has been the company's chief executive. Mr. Sloan has always been an indefatigable association worker. While in the South he was an outstanding figure in the Southeastern Section of the National Electric Light Association, and since moving North he has won an enviable reputation as an authority on public relations.

John H. Donahue, formerly connected with Abbott-Merkt & Company, Tullytown, Pa., has been made electrical superintendent with the Phoenix Utility Company, New Orleans.

K. V. Farmer, formerly superintendent of the electric department of the Syracuse Lighting Company, is now electrical engineer with the Schiefer Electric Company, Syracuse, N. Y.

Edward J. Brannigan, formerly sales engineer with the Westinghouse Electric & Manufacturing Company, Buffalo, is now connected with the Maloney Electric Company, St. Louis.

George H. Truman, formerly with the Bates Expanded Steel Truss Company, Chicago, has become president of the Transmission Tower Fabricating Company, a newly organized company with executive offices in Chicago.

H. R. Sharpless, formerly chief engineer of the Pensacola (Fla.) Electric Company, has joined the staff of the Eastern Texas Electric Company at Beaumont and Port Arthur in the same capacity. Both these properties are under Stone & Webster management.

Bernhard Olsen has been appointed manager of the Spokane office of the General Electric Company, succeeding S. E. Gates, recently transferred to Los Angeles. Mr. Olsen has been associated with the Spokane office for twelve years.

L. B. Lincoln, manager in charge of sales and purchases of the Haber Electrical Appliance Company, successor to the Haber Die & Stamping Company, electrical division, Chicago, recently resigned. Mr. Lincoln has opened offices for himself in that city.

E. S. Meyers, formerly general manager of the Vicksburg (Miss.) Light & Traction Company, has been appointed superintendent of roadways of the New Orleans Public Service, Inc., to succeed G. C. Estill, formerly superintendent of roads and structures, who resigned. Mr. Meyers is a graduate electrical engineer of Purdue University and was in the service of the Vicksburg company for seven years.

Harry J. Vance, who has been purchasing agent for the Illinois Traction System, now a subsidiary of the Illinois Power & Light Corporation, since 1912, has been appointed manager of the Cairo (Ill.) Railway & Light Company. Mr. Vance is filling the vacancy at Cairo caused by the promotion of the former manager, Emil A. Roehry, to be division manager of the Illinois Power & Light Corporation's properties at Champaign.

H. A. Sparrow has joined the Robert June Engineering Management and Industrial Advertising Organization, Detroit. Mr. Sparrow who is a graduate of Rensselaer Polytechnic Institute, has served in the capacity of assistant sales and advertising manager of the London Steam Turbine Company of Troy, N. Y., and later as plant engineer with the New York Telephone Company of Brooklyn.

W. R. Putnam New Commercial National Section Head

William R. Putnam, recently appointed to the chairmanship of the Commercial National Section of the National Electric Light Association, has been a conspicuous figure in association activities for some time. He was one of the organizers of the Minnesota Electrical Association in 1908 and took part in the affairs of the Wisconsin Electrical Association for several years. During the year 1915 he served as chairman of the electric range committee of the Northwest Electric Light and Power Association, and he was chairman of that same committee of the National Electric Light Association in 1916, when he attracted the attention

W. R. PUTNAM

of the electrical industry as the promoter of extensive studies of the electric range and its commercial possibilities as a load builder for central-station companies.

For two years Mr. Putnam was vice-president of the Northwest association and was elected president in 1921. He has also served as vice-chairman of the national section which he has just been appointed to head.

Born in Red Wing, Minn., in 1876, Mr. Putnam was educated in the public schools of his native state and was graduated from the University of Minnesota in 1897. Two years later he poined the Red Wing Gas & Electric Company as general manager, spending ten years there before becoming general superintendent of the Menominee & Marinette Light & Traction Company. Subsequently he affiliated himself with the Dakota Power Company at Rapid City, S. D. He next became associated with the Utah Power & Light Company as sales manager and commercial manager, resigning in 1919 to take up the duties of his present office, vice-president and general manager of the Idaho Power Company, Boise, Idaho.

Ray E. King, formerly engineer for the Pennsylvania Power & Light Company, Allentown, Pa., has severed his connection with that utility to become a real estate salesman for an Allentown firm.

Commission Rulings

Rates for Serving Motion-Picture Theaters. — The Wisconsin Railroad Commission has informed the Electric Light and Water Department of Reedsburg that an electric utility should supply energy for motion-picture machines and incidental power appliances in motion-picture theaters at power rates, such rates to be available to any customer conducting such a theater who shall so arrange his wiring that separate circuits will be provided for the motion-picture machines and incidental power appliances and for the regular theater lighting.

Flat Rates Discriminatory.—Another condemnation of flat rates was made by the Wisconsin Railroad Commission in a complaint brought against the Burnett County Light & Power Company. Flat rates to certain consumers, the commission said, constituted a more flagrant act of discrimination than did the improper application of rates to certain of the company's customers or the filing of a higher rate for certain municipalities than for another, and the company was ordered to discontinue the practice as soon as its finances would permit the purchase of meters.

Company's Responsibility for Application of Unfavorable Schedule.—The Commonwealth Edison Company was required by the Illinois Commerce Commission to refund to a power consumer the difference between rates under a schedule to which the consumer had been entitled and rates actually charged under a less favorable schedule, where it appeared that the consumer did not receive a full and accurate statement of the conditions from which he could draw a conclusion as to the adoption or rejection of the more favorable contract. It had been represented to the consumer that in case of removal to a new location the removal rule of the utility would be interpreted as requiring the consumer to reimburse the utility not only for the cost of removing the old installation to the new location, but also for the cost of increasing the capacity of the line back to the company's generating station should the additional load require such increase. The commission said it did not believe the rule was ever intended by the utility company to be construed in this manner and, if it were so intended, it was in direct conflict with all the decisions which the commission had ever rendered on like questions, since such reinforcement of the distribution lines could only be regarded as a normal expense in connection with the growth of the utility's business and was no more chargeable to the additional consumer than it was to those already using power from the same distributing circuit. (In this connection see another decision of the Illinois Commerce Commission printed in the ELECTRICAL WORLD for May 17, page 1029.)

Lease of Machinery to Municipal Plant Not Under Jurisdiction of Indiana Commission.—The Indiana Public Service Commission declined to take jurisdiction over the lease of electric machinery with option of purchase from the Fairbanks-Morse Company by the city of Cannelton, put off any revision of rates until the city should have had time to make permanent arrangements for the augmentation of its electric supply, and similarly deferred decision on a petition from the Tell City municipality for a certificate of convenience and necessity to serve Cannelton.

Comparative Size of Communities No Basis for Rates. — Outages as Emergencies.—Refusing to modify the terms of a street-lighting contract between the town of Windfall and the Traction Light & Power Company by inserting a provision relative to private consumers—such action being beyond its powers—the Indiana Public Service Company also refused to predicate rates upon a comparison between the size of the community and the size of other communities, holding that only when two towns or two communities are of exactly the same size, have exactly the same investment, the same number of service lines, the same number of consumers, the same demand, and in fact when all other conditions are exactly similar, is there a basis for comparison. In a discussion of the extent to which failure of service might be considered an emergency the commission declared that all outages should be kept to the absolute minimum and every effort made to insure continuous and satisfactory service. The word "emergency," embodied in the proposed contract submitted, the commission asserted, should be interpreted according to its normal usage and no attempt made to take advantage of the clause.

Off-Peak Schedule for Idaho Power Company. — Declaring that evidence submitted at rate hearings shows that the Idaho Power Company has from the month of October to April spare generating capacity at virtually all its plants, as well as spare transmission, distribution and transformer capacity, the Public Utilities Commission of Idaho has ordered the company to show cause why a suggested schedule of rates for off-peak power should not be enforced. "It appears to the commission," the order says, "that where there is spare generating capacity and no special investment is necessary to serve the energy which could be produced by such spare capacity, rates should be established which will utilize the energy which can be produced in operating, as far as practicable, to the full extent the generating, the transmission, the transformer and the distribution capacity of the properties of the company for such industries as can utilize the same upon a reasonable rate, and it further appears to the commission that there may be hours during each twenty-four-hour day when the company has spare generating, transmission, transformer and distribution capacity and, in case it has, that the same should be utilized in furnishing energy to some beneficial use at a rate reasonable for such use."

Recent Court Decisions

Central-Station Company Held Responsible for Negligence of Its Contractor.—The Supreme Judicial Court of Massachusetts in sustaining exceptions taken in McGinley vs. Edison Electric Illuminating Company of Boston, in which the trial court had directed a verdict for the defendant, declared that the company was liable for the negligence of an independent contractor working for it who had left an open manhole unguarded into which the plaintiff fell. (143 N. E. 537.)*

Natural Gas Piped Across State Boundaries Is Interstate Commerce, Supreme Court Says.—A far-reaching decision of the United States Supreme Court touching the public utility industry was rendered recently in the cases of the State of Missouri vs. Kansas Natural Gas Company, Kansas Natural Gas Company vs. State of Kansas, and State of Kansas vs. Central Trust Company of New York. The litigation grew out of the production and purchase of natural gas in Oklahoma and Kansas by the Kansas Natural Gas Company and its piping to and delivery and sale to independent distributing companies in Kansas and Missouri, said companies reselling to local consumers. The pipe lines were continuous from the wells to distributing points, and gas from different wells was mingled for transportation. The company increased its rate from 25 cents to 40 cents in Missouri, without the consent of the state commission, and in Kansas, notwithstanding the fact that a previous order of the federal court had fixed the rate of 35 cents and the state commission had approved that rate. Three suits were begun—(1) in the federal court by the Missouri commission and a distributing company to enjoin the supplying company from increasing the rate; (2) in the Kansas Supreme Court by the Kansas commission for a writ of mandamus to compel the company to re-establish the old rate, and (3) in the federal court by the Kansas commission for an injunction. Injunctions were denied in both federal courts, but a peremptory writ of mandamus was allowed in the state court. In the United States Supreme Court the judgments of the federal courts were affirmed and the judgment of the state court was reversed. The Supreme Court held the natural gas-supplying companies' business to be interstate commerce, free from state interference; that failure of Congress to regulate certain interstate business was equivalent to a declaration that it should not be regulated; that sale and delivery of gas after transportation was an inseparable part of the interstate transaction, and that uniformity of regulation of interstate commerce was necessary even in the form of non-action.

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Manufacturing and Markets

Capital Requirements of the Electrical Manufacturing Business*

A Study of the Experience of Thirteen Companies—Pitfalls That Await Small Manufacturers—Tabulation of Distribution of Assets in Percentage of Sales

By W. A. Layman
President Wagner Electric Corporation,
St. Louis, Mo.

TWO recent personal experiences led me to make some study of the capital requirements of the electrical manufacturing business. The first was a visit from a prominent manufacturer of electrical equipment who told me that he had declined a contract aggregating $2,000,000 of business per year because he found it would require 70 cents of invested capital for each dollar of the business offered. The other was a visit from another electrical manufacturer who told me that his plant was operating substantially at full capacity without profit, and to improve this situation it was necessary for him to increase his sales since the capital investment to do this would not be large.

The first interview made very clear that the manufacturer in question knew exactly the real magnitude of the capital required to expand, while the second conclusively disclosed that the manufacturer was very meagerly informed on this question. The two interviews prompted a very careful investigation to develop what the actual capital requirements of the electrical manufacturing business are.

Requirements Underestimated

In Table I are set forth the capital requirements of thirteen companies, three of which fall in group A, five in group B and five in group C, these designations being explained in the table. In order that the data given may represent a fair average distribution with reference to varying trade conditions, I have taken, where immediately available, balance sheets of the individual companes for both 1922 and 1923. Annual sales in each instance, irrespective of the size of the company, are taken as 100 per cent, and both total and distributed capital requirements are given in percentage of annual sales.

A careful study of this table discloses some exceedingly interesting facts, as follows:

W. A. Layman

1. Capital requirements of the electrical manufacturing business, irrespective of the size of the business, are very large—much larger than generally supposed.
2. Capital requirements of this business grow very rapidly with the size of the business.
3. Annual turnover of capital is at a very low rate, irrespective of the size of the business.
4. To do a "one-man" business requires 72 cents of capital for each dollar of sales, even though these "one-man" companies, generally speaking, occupy leased plant facilities.
5. The investment in inventories, irrespective of the size of the company, is very large—approximating in all companies about one-third of the total invested capital.
6. Because of the slow turnover of inventory, the hazard of inventory losses from price variations due to trade fluctuations is very great.
7. Plant investment grows very rapidly with the growth in size of the business.

It will be interesting to segregate out of this table the distribution of capital of one conservatively capitalized company of each group. As the General Electric and Wagner Electric balance sheets are public information, I select their operating ratios as illustrating the conservative requirements of groups A and B. For group C I select a company whose capital requirements are practically the minimum for conservatively financed "one-man" companies, not naming this company, however, since its balance sheets are not given general publicity. The analysis is shown in Table II.

From the comparison of three typical companies, as shown in Table II, several things will be immediately observable, as follows:

A. The "one-man" company has little or no plant investment, carries little or no cash on hand, has a heavy investment in inventory and must figure on not less than sixty days' average for accounts receivable.

B. To move from the "one-man" company class into the intermediate group the small company must at once jump up very much in plant investment, must expand its cash balances in bank substantially and also substantially increase its inventory investment.

C. For the intermediate man to go into the large class would call at once for very heavy additions to investment—particularly in working cash balances, notes and accounts receivable, and miscellaneous investment items.

Needs of Inventory

There has been a very widespread lack of appreciation of the capital requirements of the electrical manufacturing business for inventory purposes alone. Table III, covering some of the leading companies, will clearly indicate not only that 1922 and 1923 inventory requirements, as shown in Table I, are large, but also that the average inventory requirements over a long period of time are uniformly large.

A comparison of the inventory requirements for the years 1922 and 1923 with Table III will indicate clearly that some of the companies recognize in a very keen way the desirability of reducing their inventory investments to a lower level; but in some instances inventories have down to date continued at very high values. It is a fair inference from all of the figures shown that it re-

*Abstract of paper presented before the Electric Power Club, Absecon, N. J., May 27, 1924.

quires excellent management to hold inventories down below 45 per cent of the annual sales turnover for the group A companies, 40 per cent for the group B and 30 per cent for the group C.

FIVE PRESENT WEAKNESSES

I should like to make the following very frank observation, based upon many years' experience in the electrical manufacturing business:

1. There is a very large highly trained personnel of engineering talent in this industry. Because of the engineering allurement which the business offers there is the constant temptation for engineers to organize small electrical manufacturing companies. In the main these small business ventures are undertaken without a fair comprehension of the capital requirements of the industry. In the early stages of such ventures, and particularly when trade conditions are good, it seems very easy to make a comfortable profit. As the business begins to expand there is a gradual awakening to the fact that the capital requirements of the business grow at a substantially faster rate than the volume of sales. Soon the company passes beyond the "one-man" stage and then begins to get into territory where the keenest and most careful kind of management is essential to success. The problems of financial organization constantly and seriously increase, and in time the business reaches a point where the management, stockholders and bankers discover that the capital requirements are far beyond those of the ordinary commercial business and that the most competent of management and the wisest of trade policies are essential to the maintenance of the business upon a successfull basis.

2. I have observed that the so-called "one-man" business is not only started without an accurate knowledge of the capital requirements of the industry, but also without a crystallized conception of those trade policies which are really essential to commercial prosperity in this industry. So long as the business is very small in size production costs are low, although by no means so low relative to the large producers as the small business believes. On the theory that production costs are very low, a trade is built up on a low price level relative to the normal market price of the industry. As the business grows this low price level fails to maintain the business in prosperous condition, and about the time the business is ready to pass from group C to the group B, growing begins to get difficult, financial embarrassments begin to manifest themselves, and future stability is jeopardized if price policies are not adjusted more nearly to the normal market levels.

3. There is a great tendency throughout the industry to indulge in mass competition. I mean by this a tendency to confine production to strictly standard products which many well-developed companies are manufacturing. Particularly are the small companies prone to concentrate their energies on these so-called standard lines. With their limited capacity, they might far better engage in specialty production and keep away from mass competition, both to their own and the general market advantage.

4. In the electrical business, as in all other industries, there are numerous companies operating without adequate cost-keeping systems, and sales policies are based upon erroneous conclusions as to what actual costs are. By virtue of the very slow turnover in the manufacturing operations of the electrical business it is considerably more difficult to ascertain reliable costs and to keep posted up to the minute on costs than in the majority of lines of other manufacturing business. Manufacturing costs on which commercial policies are based are frequently out of date.

5. It seems to be a besetting sin of the electrical manufacturing industry to endeavor to cover up unsound commercial policies, inadequate cost-keeping information, high costs of production because of out-of-date designs and other phases of mismanagement by a constant endeavor to increase volume of sales for the purpose of reviving declining profits. This process overlooks the fact pointed out in the data of this discussion—namely, the tremendous amount of capital required to handle an increase of volume of sales ($1.41 of new capital, in round figures, on the average, for all companies for $1 of additional sales). Because of this large capital increase required with new business an increase in volume as a remedy for low percentage of profit

TABLE I—DISTRIBUTION OF ASSETS OF ELECTRICAL MANUFACTURERS IN PERCENTAGE OF ANNUAL SALES*

	Company No.	Year	Annual Sales	Plant and Equipment	Cash and Equivalent Items	Notes and Accounts Receivable	Inventories	Miscellaneous Assets	Total Assets	Capital Required per Dollar of Sales
Group A										
Three large companies whose total assets exceed $50,000,000 each	1	1922	100	33	43	19	44	38	177	$1.77
		1923	100	22	33	22	31	30	138	1.38
	2	1922	100	40	6	24	55	17	142	1.42
	3	1922	100	151	50	35	48	2	286	2.86
		1923	100	118	32	34	48	6	238	2.38
Average of Group A (1922 and 1923)				72.8	32.8	26.8	45.2	18.6	.....	1.96
Group B										
Five intermediate sized companies the average of whose total assets is approximately $6,500,000 each	4	1922	100†	106	5	15	34	.....	160	1.60
		1923	100	106	6	11	40	2	165	1.65
	5	1922	100	108	3	31	47	7	196	1.96
		1923	100	72.49	3.25	24.69	49.46	7.31	157	1.57
	6	1922	100	113	9	17	76	27	242	2.42
	7	1922	100	44‡	4	17	33	1	99	0.99
		1923	100	33	3	15	35	1	87	0.87
	8	1922	100	64	6	15	48	4	137	1.37
		1923	100	47	11	12	36	3	109	1.09
Average of group B (1922 and 1923)				77	5.58	17.5	44.2	6.53	.....	1.50
Group C										
Five small companies (virtually "one-man" companies) the total of whose assets does not exceed $275,000	9	1923	100	12.25‖	0.2	16.35	25.26	6.67	60.73	0.607
	10	1923	100	22	3	12	9	7	53	0.53
	11	1923	100	16	2	11	28	4	61	0.61
	12	1923	100	36.22	3.05	15.20	27.9	3.25	85.62	0.856
	13	1923	100	51.04	2.19	13.87	21.48	8.03	96.61	0.966
Average of group C (1923)				27.50	2.08	13.68	22.33	5.79	.....	0.71
Average of groups A, B and C (1922 and 1923)				62.89	11.82	18.95	38.74	9.68	.....	1.41

* Taken from balance sheets published or available through credit agency channels.
† Annual sales estimated.
‡ About one-half of real estate and buildings leased.
‖ Probably lease all real estate and buildings.

TABLE II—ANALYSIS OF CAPITAL DISTRIBUTION

	General Electric Company, 1923	Wagner Electric Corporation, 1923	Group C Company, 1923
	Per Cent		
Annual sales	100	100	100
Plant and equipment	22	47	12.25
Cash and equivalent items	33	11	0.2
Notes and accounts receivable	22	12	16.35
Inventories	31	36	25.36
Miscellaneous assets	30	3	6.67
Total assets	138	109	60.73
Capital required per dollar of sales	$1.38	$1.09	$0.607

TABLE III—INVENTORY INVESTMENT OF SIX COMPANIES

Name of Company	Period, No. of Years*	Average Inventory Investment in Percentage of Annual Sales
Westinghouse Elec. & Manufacturing Company	10	46.2
General Electric Company	11	40.7
Allis-Chalmers Manufacturing Company	6	47.3
Century Electric Company	7	38.7
Emerson Electric Company	2	35
Wagner Electric Corporation	12	38

*The abnormal years of 1919, 1920 and 1921 eliminated.

in sales is almost a hopeless path toward happier operating results.

In conclusion, I would say that the capital requirements of the electrical manufacturing business are worthy of the most careful and continuous investigation, not only of the men already engaged in the industry and the bankers who have advanced capital to assist in the operation of the industry, but also particularly worthy of the careful study of engineers who may be contemplating the starting of new businesses and of capitalists whose financial support is being invited into new ventures in the field of electrical manufacture. We have a great business—one with a great future ahead of it—but it is a business which calls for management of the highest order, an intelligent knowledge of the fundamental economic facts involved and a most careful determination of commercial policies essential to financial success.

Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

A STEADY volume of business continues to be transacted in the electrical industry, although sales are spotty and the demand is uneven. The growing tendency for business to improve continues in the Middle West, and there has been some improvement in industrial activity in other sections of the country. The feeling still is general that there will be a very decided improvement shown in the fall. Interesting orders placed were one for over a million dollars' worth of generating equipment for a new central station and another for turbo-electric propulsion equipment for a large passenger vessel.

There has been an uneven demand for electrical material in New England, with little change. A number of industrial plants in this territory are doing active betterment work. In New York orders are spotty and uncertain, but aggregate business is good, and fan sales have fallen off below normal. Industrial buying has improved in the Southeast, several satisfactory orders having been received for textile-mill electrification, and manufacturers report the outlook as encouraging. In the Middle West the tendency is toward better business conditions, utilities have been purchasing more commodities, and distribution and high-tension equipment has been very active. Trade has shown an improvement on the Pacific Coast with the exception of the Los Angeles district, which is slow. Water shortage for hydro-electric plants is still causing a curtailment of electricity and is affecting sales.

Little Increase in Ten Years in Price Trend of Wiring Materials

A COMPARISON of wiring-material costs made by Charles L. Eidlitz, chairman of the board of governors of the Electrical Board of Trade, shows that manufactured material has only increased 15 per cent from the low mark of 1914 as compared with June, 1924. The comparison was made by taking the estimate of a combination loft and office building, which was actually figured in January, 1914, at a cost for materials of $9,070.71, and with this as a basis the various material items were repriced at different periods with the following result:

January, 1914	$9,070.71
September, 1920	16,952.49
January, 1921	14,873.91
June, 1921	11,660.49
January, 1922	10,404.61
January, 1923	11,592.23
June, 1924	10,428.19

In making this comparison it must be borne in mind that in the type of job selected the conduit used is not a very large item, which accounts for only a 15 per cent increase Conduit by itself has shown a higher increase during this same period, so that where large quantities are used on a job the net increase will be somewhat higher.

By comparing installation labor costs over the same period it will be seen that this has increased 260 per cent, provided that the same amount of work per hour is being performed now as then, which, however, is not believed to be the case. In 1914 a journeyman and helper received $6.70 per day, whereas to-day they are being paid $17.50 per day.

Small Demand for Boilers—Prices Low—Deliveries Good

THE demand for boilers is at present considerably below the existing manufacturing capacity as it has been for some time past, with the exception of those companies that make a specialty of heating boilers. The general opinion is that the boiler market is affected by the political situation and the future demand is expected to improve during the fall. Sales during the last four or five months have been more or less forced; that is, boilers have been purchased because they were absolutely needed for present needs, rather than with any idea of anticipating future requirements. Manufac-

VALUE OF ELECTRICAL EXPORTS FOR MAY, 1924, COMPARED WITH CORRESPONDING MONTH IN 1923

	May 1923	May 1924
Generators:		
Direct-current:		
Under 500 kw.	$73,539	$107,395
500 kw. and over	50,780	66,167
Alternating-current:		
Under 2,000 kva.	1,452	6,319
2,000 kva. and over	34,600	37,252
Steam-turbine generator sets	*	2,312
Accessories and parts for generators	54,445	113,427
Self-contained lighting outfits	74,869	100,532
Batteries:		
Flashlights	*	98,530
Other primary	115,742	68,333
Storage	229,229	263,670
Power transformers	129,494	431,358
Other transformers	63,680	229,098
Rectifiers, double-current and motor generators, dynamotors, synchronous and other converters	33,831	67,109
Switchboard panels, except telephone	156,760	186,208
Switches and circuit breakers over 10 amp.	119,316	180,039
Fuses and fuse blocks	30,983	30,162
Watt-hour and other measuring meters	39,709	25,498
Volt, watt and ampere meters and other recording, indicating and testing apparatus	74,561	114,014
Lightning arresters, choke coils, reactors and other protective devices	23,372	130,780
Motors under 1 hp.	236,970	172,905
Stationary motors:		
1 hp. to 200 hp.	238,544	190,254
Over 200 hp.	20,715	27,704
Railway motors	19,391	144,049
Electric locomotives:		
Railway	206,484	107,132
Mining and industrial	3,525	43,857
Other motors	13,712	†
Starting and controlling equipment:		
Industrial motors	*	172,439
Electric railway and vehicle	*	3,815
Rheostats, controllers and other starting and controlling equipment	133,703	†
Accessories and parts for motors	142,600	208,503
Electric fans	54,788	122,824
Electric lamps:		
Incandescent:		
Carbon-filament	3,923	7,974
Metal-filament	92,691	97,226
Other electric lamps	20,596	23,605
Flashlights	47,447	76,348
Searchlights and projectors	8,772	22,080
Motor-driven household devices	78,678	78,795
Domestic heating and cooking devices	84,121	95,801
Industrial electric furnaces and ovens	16,828	34,171
Therapeutic apparatus, X-ray machines, galvanic and faradic batteries	84,558	73,117
Radio and wireless apparatus	213,025	295,677
Telegraph apparatus	23,317	46,328
Telephone apparatus:		
Magneto telephones	31,259	10,077
Other telephones	20,986	38,853
Magneto switchboards	5,873	1,694
Other telephone switchboards	130,190	75,966
Other telephone equipment	*	204,539
Railway signals, switches and attachments	29,214	118,551
Bells, buzzers, annunciators and alarms	5,628	10,469
Spark plugs, magnetos and other ignition apparatus	90,494	163,500
Insulating material	132,634	122,487
Metal conduit, outlet and switchboxes	54,671	70,894
Sockets, receptacles and lighting switches	125,738	265,710
Other wiring supplies and fixtures	139,010	†
Electric lighting fixtures, interior and street	*	72,165
Other wiring supplies and line material	*	107,118
Other electrical apparatus, not elsewhere specified	636,756	668,543
Globes and shades for lighting fixtures	34,538	44,661
Electrical glassware, except for lighting	16,012	17,134
Electrical porcelain	123,284	134,856
Electrical carbons, carbon brushes, electrodes	190,968	254,158
Insulated wire and cable (iron and steel)	33,678	32,497
Other manufactures of aluminum	102,975	57,570
Copper:		
Bare wire	100,969	99,513
Insulated wires and cables	293,941	332,825
Total electrical machinery and apparatus and supplies	$5,349,568	$7,206,587

* Not separately stated prior to January 1, 1924. † Discontinued beginning January 1, 1924.

turers of return-tubular boilers anticipate that any increase in demand for this type of equipment will be more for use in heating than for power installations because of the general confidence in central-station power.

Boilerplate, tubes and other material entering into boiler construction can be obtained promptly at the present time. Accordingly, deliveries of boilers are very good and are limited only by the requirements of the purchasers. That is to say, standard boilers can be delivered on very short notice. Stock deliveries can be obtained on return-tubular boilers of 85 hp. to 250 hp., 150 lb. pressure.

Present prices, which closely follow the steel and tube market, are considered as low beyond reason, owing chiefly to small demand and keen competition. It is not believed that these prices can be maintained when the demand improves, and an upward revision is looked for in the near future.

Another Quiet Week in Metal Market—Prices Stationary

A SLIGHTLY better tone prevails here and abroad as a result of small advances in the foreign market, but there has been no improvement in the volume of business transacted. Prices of copper remain practically unchanged. Some sales were made at 12¼ cents, delivered, for July, August and September, and some quotations advanced to 12⅜ cents, but all sales made were recorded at 12¼ cents. More copper is still being produced than is consumed, and the present position of the producers is more unsatisfactory than at any time since the first of the year.

There is little activity in the lead market. There was a fair amount of orders booked in the last few days, mostly for July delivery, on the average contract basis. Prices remain the same.

NEW YORK METAL MARKET PRICES

	June 25, 1924 Cents per Pound	July 2, 1924 Cents per Pound
Copper, electrolytic	12⅛	12⅛
Lead, Am. S. & R. price	7.00	7.00
Antimony	8⅛–8¼	8⅛–8¼
Nickel, ingot	27	27
Zinc, spot	6.10	6.15
Tin, straits	43⅛	44⅛
Aluminum, 98 to 99 per cent	28	27½

Tin continues to show strength due to the foreign market, but the demand has been small with a consequent increase in warehouse stocks.

The zinc market has been dull but steady with no pressure to sell. Bids for a large amount at a shade below the nominal market have been made but not accepted. Several important producers announced their intention of closing down for about two weeks early in July, so that the price is not liable to decline.

Sales Spotty in New York District —A Large Order Placed

ALTHOUGH there is still an uncertainty of orders in the New York district and sales are spotty, the volume of business transacted is good. Some manufacturers report sales during the month of June as very good, while others report June sales as equal to April but not so good as May. Taken as a whole, the volume of business done in June should be equal to or better than that done in May. Motor sales are still slow. During the week announcement was made of the purchasing of more than a million dollars' worth of generating equipment for a new power station in this district. There is also a steady demand for pumps, although orders are small.

The strong demand that started last week for fans did not continue, owing to the change in the weather, so that total sales to date are under normal. Jobbers report that June sales were not quite up to those of May. Radio business continues fair and is still about twice as large as for the same period last year. There is no surplus stock on dealers' shelves and delivery of radio apparatus is still backward.

Uneven Demand with Little Change in New England

LITTLE change can be seen in the demand for electrical supplies in New England compared with last week. Apparatus makers are busy filling standing orders and motor sales are still around two-thirds of the volume of a year ago. A number of industrial plants are doing active betterment work, and one large textile machinery manufacturer is about to begin the use of purchased power, with a contract load of 3,000 hp. and prospective complete electrification of his factory.

Jobbers report a gain in optimism among retail buyers and widespread confidence in a good volume of fall trade. Electric flatirons and vacuum cleaners are moving reasonably well, and there is a better demand for domestic lighting fixtures in some quarters than at this time last year. Reflector sales are hampered by very unstable price conditions and reported narrow margins of profit. There has been a tendency toward softening prices on the better grades of wire. Nationally announced lamp price reductions, made July 1, have been appreciatively received. The broadcasting of the national conventions has helped radio sales, and retailers owe much to the co-operation of regional stations, which has made reception positive at this season of the year.

Southeast Outlook Encouraging— Industrial Buying Improves

SEVERAL of the large manufacturers report the general outlook in the Southeast as encouraging, particularly along industrial lines. Several satisfactory orders were received last week for textile-mill electrification and for the enlargement of lumber mills in Mississippi and Louisiana. Also, there is a general impression that the phosphate-mining business in Florida is destined for a reawakening in the very near future, and this will call for the purchase of considerable electrical apparatus of the large type, particularly pumping equipment and line equipment, with some turbine business. Oil-engine generating sets continue to sell actively, especially in south Georgia and Florida.

The jobbing business is holding up well, although no orders of moment have been placed. While construction in the territory as a whole is very satisfactory, building permits in Atlanta for the first five months of the year are under those of the same period last year, and this is reflected in the slowing up of retail business in that city. Fan sales are particularly good. Farm-lighting outfits are moving slowly.

Business in Middle West Continues Upward—Week Active

FROM all apparent indications the tendency toward better business conditions continues to be observed in the Middle West. Utilities have purchased more commodities and of a more varied character. The spirit of cautiousness seems to be abating somewhat. The demand for distribution and high-tension equipment was most active, but motors were reported as moving slowly. Maintenance purchases increased, and generally this week was more active than last. Prices remained firm in most instances, but in some cases where keen competition was encountered reductions were made.

In the last few months most jobbers' stocks have been reduced to a minimum. However, they now appear to have reached the point where heavier replacement is necessary and more active buying is noted. Fans, which should have moved faster at this time, are, because of the cool weather, moving slowly. Appliance sales have not been up to the standard of last year. It is admitted, however, that they are better than they were expected to be several months ago. It is generally conceded that the month of June closed better than the month of May, and optimism is prevalent. Building activity continues strong. The permits taken out for the month of June exceeded in number those issued last year, and the value was considerably greater. The building boom has apparently not reached its peak.

Trade Improves on Pacific Coast —Still Quiet in Sections

THE electrical trade on the Pacific Coast is better in volume and tone with the exception of the Los Angeles district, where it is still quiet. An interesting order was one for 1,300 miles of copper wire placed by the Southern Pacific Railroad for delivery along its system. Government purchasing is at present good, principally because of purchasing prior to July 1, the beginning of a new fiscal year, and consists largely of standard wiring material. With 500 new residences planned for San Francisco the movement of staple building material in that section is expected to improve.

The water shortage is still being felt in California in the curtailment of electricity for power and lighting, but it is expected that rains in the fall, and selling campaigns will revive illuminating and lamp business, which has suffered therefrom. Larger household appliances are moving rather slowly—a condition ascribed by some to the usual summer exodus and by others to intensive radio selling to the neglect of other business. Flashlight business is very good.

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

Savage Arms Denies Rumors of Electrical Sales

On account of a number of articles appearing in the financial papers regarding the Savage Arms Corporation, as applying to the extent of the company's business in electrical devices, the company states that the manufacture of sporting arms is still by far its greatest revenue producer. The company's business in the second quarter will show good results, particularly on account of the seasonal character of the sporting-arms demand.

The sale of Savage washing machines, however, has increased at a satisfactory rate. The predictions made as to the volume of business for the year are premature.

De Laval Forms Pacific Coast Sales Organization

The formation of a Pacific Coast sales organization is announced by the De Laval Steam Turbine Company, Trenton, N. J. The states of California, Oregon and Washington and part of the adjoining states are covered under the direction of William Pullen, with offices in Los Angeles, San Francisco and Seattle.

The Los Angeles district office is at 312 Union Oil Building and is in charge of Ivan E. Goodner. The San Francisco district office is at 531 Rialto Building and is in charge of Mr. Pullen, assisted by Eck Baughn and Charles P. Markley, a mechanical expert from the company's works. The Northwestern district office is at Seattle, 1306-7, L. C. Smith Building, and is in charge of James Q. Osborne, assisted by F. A. Hurlbut.

Canadian Electrical Companies Busy on Heavy Equipment

With extensive hydro-electric power developments in different parts of the country, the Canadian General Electric Company and its subsidiary, the Canadian Allis-Chalmers Company, are busy on heavy equipment, including turbines and generators. The Montreal works are particularly busy. However, business in general industrial equipment and in household electrical fixtures is comparatively quiet.

The Canadian General Electric is playing an important part in the development of hydro-electric power and the marketing and consumption of electricity in Canada. Developments now under way will greatly increase the supply of power, perhaps create more than enough for present demands in some districts, but already in some parts of the country there are other projects under consideration.

Representing the General Electric Company of the United States, which has secured control of the Canadian General Electric, D. C. Burland has been made a director of the Canadian company and has associated himself with the management at Toronto.

General Electric Receives Turbine and Motor Orders

The General Electric Company has received an order for the first two turbo-generators to be used in the new power plant of the New York Edison Company. These machines have a rated capacity of 60,000 kw. at unity power-factor, 25 cycles, 11,400 volts, three-phase, to operate at 1,500 r.p.m., and are equipped with direct connected exciters. The steam pressure used will be 350 lb. at a maximum temperature of 700 deg. F.

The company has also received a contract for turbine-electric propulsion equipment for a seagoing passenger liner of the American-Hawaiian Steamship Company. The equipment will consist of two Curtis turbo-generators of 7,700 kw. each, which in turn will drive two synchronous motors of 10,000 hp. directly connected to the propellor shafts.

Post-Glover and General Electric to Occupy New Building

The General Electric Company has let a contract for the erection of a large office and warehouse building at 215 West Third Street, Cincinnati, to be occupied jointly with the Post-Glover Company, its Cincinnati distributor. The building will contain 102,000 sq.ft. of floor space, provision in the construction being made for the addition of two more floors, giving a total area of approximately 142,000 sq.ft. The topography is such that the building will be five stories high on Pearl Street and four stories high on Third Street.

The warehousing facilities will be very complete. The two ground floors will have ceilings of from 17 ft. to 20 ft. high and will contain complete mechanical apparatus for handling all sorts of equipment. A railroad siding is provided on one side of the building.

Arc-Welding Equipments Ordered from Westinghouse

The Atcheson, Topeka & Santa Fé Railway system recently placed an order for twenty-eight arc-welding equipments with the Westinghouse Electric & Manufacturing Company. These equipments will be distributed among fourteen of the railway company's shops, from Chicago to the Pacific Coast, and the order is one of the largest ever placed for welding equipment.

Boston Jobber Moves Into Larger Quarters

The Louis Model Company, formerly at 44 Portland Street, Boston, has moved to 133 Federal Street, where quarters aggregating 13,500 sq.ft. are being devoted to sales service in comparison with about 9,000 sq.ft. at the former location. A feature of the new establishment is a fixture studio on the street floor consisting of a series of rooms decorated in polychrome, gray, silver, gold and brown and crystal. These rooms can be seen from the main salesroom at the front of the house, each being bisected by a passageway from front to rear. Three floors are occupied in the new quarters and the company has just taken over the agency for the Laundryette washer. Louis Model is president and treasurer, and M. Kasac is sales manager of the company.

The Bryant Electric Company, Bridgeport, Conn., announces that it has redesigned a number of its wiring devices. These include the No. 699 "Spartanette" attachment plug, the No. 59107 outlet box receptacle and the No. 95 "Wrinklet" keyless socket body. The company has also developed a new design of appliance switch plug.

The Penn Electrical & Manuufacturing Company, Irwin, Pa., manufacturer of switchboards and panelboards, has just completed an addition to its building which practically doubles its capacity. The company, in addition to serving the Pittsburgh territory, has branch offices in Philadelphia, Baltimore, New York and Buffalo. A large increase in sales is reported, the company having recently secured several good-sized contracts.

The John A. Roebling Sons Company, Trenton, N. J., has had made by the Pathescope Company, New York, a five-reel film showing the making of wire rope from the time the iron is put in the furnace to the finished product. The film shows particularly the various tests to which the material is subjected and must pass before it is used in the manufacture of rope as well as tests on the completed rope.

The Packard Electric Company, Warren, Ohio, opened a new district office for the transformer division in Atlanta, Ga., on July 1. S. A. Redding is district manager in charge. Mr. Redding spent many years with the Georgia Railway & Power Company of Atlanta and for the past five years has been engaged in consulting and construction engineering work with headquarters in Rio de Janiero, Brazil.

The Robert June Engineering Management Corporation of Detroit, which handles industrial advertising, sales development and engineering management, is moving to 8835 Linwood Avenue. This move more than doubles the office space and is made in order to provide better facilities for service to the organization's clients.

The Gibb Instrument Company, Bay City, Mich., manufacturer of electric welding machines, announces that since July 1 its Chicago office has been in charge of W. F. Hebard & Company, 551 West Van Buren Street. Thomas

Barnes, an officer of the Hebard Company, will head the welding department assisted by Charles Watson, who has had many years of service with the Gibb Company and has been associated with the Chicago office for the past two years. Mr. Hurd, the retiring representative, will look after the interests of the company in New England after August 1.

The Louis Allis Company, Milwaukee, motor manufacturer, announces the opening of a New York office at 345 Madison Avenue. George Sherrerd, Jr., has been appointed manager.

The Norwalk Iron Works Company, Norwalk, Conn., manufacturer of air and gas compressors, has sold its plant, equipment and good will to Charles B. Stanley, a Cleveland banker. Immediately following the purchase the property was transferred to the Norwalk Company, a new corporation, which will operate the plant in the production of its familiar products.

The Electro Thermal Machinery Company, Inc., New Haven, manufacturer of electric heating apparatus for the heat treatment of steel for tempering and forging, are preparing plans for a fireproof structure 182 ft. x 88 ft. The plant will have a capacity of twelve machines weekly. The officers of the company are: Joseph E. Perry, president; Edwin S. Pickett, vice-president; Daniel J. O'Keefe, secretary and treasurer, and Frank W. Thompson, electrical engineer and technical director.

The Stevens-Aylsworth Company, Inc., New York, contracting engineer, announces that after July 1, 1924, Roger B. Stevens will be associated with the organization as manager of the engineering and sales departments. Mr. Stevens was formerly with McClellan & Junkersfeld, Inc., engineers and constructors.

The Cochran Electric Company, Woodlawn, Pa., has been recently organized by H. J. Cochran and will act as distributor of electrical goods, motors, etc., as well as conduct a general electrical repair plant.

The Russell Electric Company, Chicago, announces the manufacture of a new model "Hold-Heet" curling iron to retail for $2.

The Reynolds Electric Company, Chicago, manufacturer of fractional-horsepower motors and motor-driven appliances, announces that W. L. Nies, who has been in charge of its engineering department, has been transferred to the sales department.

The Electric Furnace Construction Company, Philadelphia, has designed and installed a continuous electric vitreous enameling furnace, the first of this type ever constructed, at the Armstrong Manufacturing Company's plant at Huntington, W. Va.

The Republic Electric Company, Cleveland, wholesale distributor, has installed a lighting-fixture department and has opened display rooms for the use of the dealers and their customers. This department is in charge of J. L. Wolf. The Wahle line of residential lighting fixtures and the Ivanhoe line of commercial and residential glassware is being handled by the company.

The Fostoria Glass Company, Moundsville, W. Va., has appointed H. O. Swoboda, Inc., Pittsburgh, as consulting engineers to make improvements to their power plant, including the installation of a new generating unit. The plans and specifications are in work and will be completed shortly.

The Wagner Electric Corporation announces that on June 23 its Philadelphia office and service station was removed to 1720-26 Callowhill Street. Elmer Lingard continues in charge at the new location.

The May Oil Burner Corporation, Flushing, N. Y., manufacturer of automatic oil burners, is now placing on the market a new domestic oil burner with complete automatic temperature control. The blower is directly connected to a ¼-hp. type CAH, Westinghouse electric motor.

The Canadian General Electric Company has let a contract for the erection of extensions to its Peterboro (Ontario) plant, work on which will be commenced at once. The erection of these buildings follows the passing of a by-law providing fixed assessment for the company.

The Killark Electric Manufacturing Company, St. Louis, has recently placed on the market a new conduit fitting for 3½-in. and 4-in. conduits. This fitting has been made by the company in smaller sizes for several years. It is known as the type FB and may be used either vertically or, by reversing the cover, horizontally. Several new features are incorporated in the larger-size fitting, one of which is a long hub which permits of a long-radius bend in the cable.

The Ivanhoe Division of the Miller Company, Cleveland, is now manufacturing a line of motor-bus lighting-reflector units.

The Brightson Laboratories, Inc., Newark, N. J., lately organized, has leased the three-story building at 73 Winthrop Street, approximating 10,000 sq.ft. of floor area, and will remodel and improve it for the manufacture of radio equipment and instruments. George E. Brightson is president.

The Strand & Sweet Manufacturing Company, Winsted, Conn., manufacturer of magnet wire, etc., has filed plans for the construction of an addition to its plant, to cost approximately $30,000.

The Westinghouse Electric & Manufacturing Company, Springfield, Mass., has awarded a contract for a new one-story plant addition estimated to cost $42,000, work on which will proceed at once.

The John A. Roebling's Sons Company, Trenton, N. J., has acquired property, 200 ft. x 400 ft., bounded by Sixteenth and Seventeenth Streets, San Francisco. Plans will be prepared for the erection of a factory branch and distributing plant, estimated to cost about $250,000, with equipment.

New Equipment Available

Short Descriptions of New Apparatus and Accessory Equipment of Interest to the Electrical Industry and Available from Manufacturers and Announcements of New Lines

Oil Circuit Breaker

An oil circuit breaker of single-unit construction designed for use in medium-sized distributing systems has been placed on the market by the Condit Electrical Manufacturing Company, South Boston, Mass. The breaker is provided with one-piece wet-process porcelain bushings securely fastened at four points on the frame. It is designed for flat surface and pipe-frame mounting. The steel tanks are ¼ in. thick, have welded seams, are fastened at four points on the frame and are lined throughout to provide additional insulation.

The contacts are of the brush type and are constructed of hard-drawn copper laminæ. The breaker can be furnished for manual operation or electrical remote control in ratings of 600 amp. or less, 25,000 volts; 800 amp. or less, 15,000 volts, and 1,200 amp., 7,500 volts, at 60 cycles.

Resistance Starter.—A new design of manually operated, inclosed resistor starter of the safety type for squirrel-cage induction motors up to 20 hp., 550 volts, under light load, is being made by the General Electric Company. The resistance is proportioned to give an in-rush current of three and one-half times the normal full-load motor current. It is furnished with a single-step resistor, equal parts of which are connected in each phase. The switching elements are of the contact finger type. Overload and undervoltage protection is provided.

Crawling Tractor Crane

A 10-ton crawling tractor crane with independent control of the traveling, slewing and hoisting motions that may be utilized in a variety of combinations, said to result in greatly increased speed and efficiency of operation, has been developed by the Industrial Works, Bay City, Mich. The entire upper part of the crane rests on a steel base which rotates on four conical steel rollers that may be taken out without removing any of the parts or jacking up the crane. Heavy steel side frames which carry the shaft bearings are bolted to this rotating bed.

The crane has two traveling speeds, and reversal of direction is accomplished by reversing the engine. It is built for either steam, electric or gasoline power and can be operated with clamshell or dragline bucket, electromagnet, hook and block or grapple. It is also readily convertible into a shovel or a piledriver.

New Trade Literature

BALL-BEARING MOTORS.—The Star Electric Motor Company, Miller Street, New Jersey Railroad Avenue and King Street, Newark, N. J., has issued new price and data sheets covering the various types of the "Star" direct-current and alternating-current motors.

STAND-LAMP CLUSTERS.—The Benjamin Electric Manufacturing Company, 847 West Jackson Boulevard, Chicago, is distributing a bulletin calling attention to the "Benjamin" stand-lamp clusters for making floor and table lamps, converting oil and gas lamps and for making over pottery, wooden and wickerware vases into electric lamps. The company has also published two leaflets, one covering its "Benco" weatherproof socket and the other its showcase lighting equipment.

BOILER INSULATION. — "The Insulation of Boilers" is the title of bulletin B-6e issued by the Celite Products Company, Chicago, which describes in detail the method of insulating employed for various types and sizes of boilers and gives figures on the fuel savings which can be realized by insulation.

SAFETY SWITCH AND PLUG. — The Crouse-Hinds Company, Syracuse, N. Y., has issued bulletin No. 2,053, describing its "MKS" series of interlocking safety switches and plugs for use with portable electrical appliances.

OIL-BURNING FURNACE.—The Marion Machine Foundry & Supply Company, Marion, Ind., has issued catalog No. 130, describing the "Marion" line of oil-burning furnaces and air indicators.

ELECTRICAL INSTRUMENTS. — The Roller-Smith Company, 233 Broadway, New York City, is distributing bulletin No. 110, covering its type "HD" direct-current small portable instruments, and No. 150, describing its type "HA" small alternating-current portable instruments.

LIGHTING SYSTEMS. — The Western Electric Company, 100 East Forty-second Street, New York City, has issued a booklet, entitled "Western Electric Lighting Manual," giving information on commercial and industrial lighting and presenting in simple terms the fundamentals of electric lighting. It also describes representative systems of lighting and types of fixtures and offers suggestions to assist in selecting and applying those most appropriate and useful.

ELEVATOR CONTROLLERS AND AUTOMATIC STARTERS. — The Sundh Electric Company, 5 Avenue C, Newark, N. J., is distributing a new catalog covering its complete line of elevator control devices for both direct and alternating current. Bulletins Nos. 5,800, 5,801, 6,100 and 6,101 issued by the company describe its primary-resistance type of automatic starters for squirrel-cage motors, both open and inclosed types, and slip-ring motor automatic starters.

ELECTRICAL INSTRUMENTS. — The Roller-Smith Company, 233 Broadway, New York City, is distributing a supplement to bulletin No. 400 calling attention to its type "DT" volt-ammeters. Bulletin No. 160 issued by the company describes its type "GSA" alternating-current portable instruments.

SLACK PULLER.—The W. N. Matthews Corporation, St. Louis, is distributing bulletin No. 700 calling attention to the Matthews slack puller.

INSULATING VARNISHES AND COMPOUNDS.—"Westinghouse Insulating Varnishes and Compounds" is the title of a booklet issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., known as folder 4249-B, which contains complete information for using the various varnishes, insulating compounds and finishing materials manufactured by the company.

INDUSTRIAL TRACTORS AND TRUCKS.—The Baker R & L Company, Cleveland, has just issued catalog No. 24, describing its complete line of industrial tractors and trucks. A short history of the company is given, electrical material handling is discussed, and the part that standardization plays in the various types of tractors and trucks manufactured by the company is shown. General specifications are given, and the various types of tractors and trucks are described with their individual specifications.

CONDENSER TUBES. — The Scovill Manufacturing Company, Waterbury, Conn., has issued a new booklet on condenser tubing which gives a brief, non-technical description of the cupping process and other operations in connection with the manufacture of Scovill Admiralty condenser tubing, as well as the process for making Scovill special Muntz metal condenser tubing. Separate specifications for both Admiralty and Muntz metal condenser tubin ghave been issued in connection with the booklet. The specifications cover the manufacture, chemical properties and tests, physical properties and tests, permissible variations in dimensions and workmanship and finish of these tubings.

TRANSMISSION-LINE STRUCTURES. —The Pacific Coast Steel Company, Rialto Building, San Francisco, has issued a catalog on galvanized-steel transmission towers and poles. Factors affecting tower design and steel-pole costs are discussed and a chapter is devoted to methods of erecting towers. The open-hearth process of manufacturing steel is explained and many illustrations are used throughout the catalog.

Foreign Trade Opportunities

EQUIPMENT FOR ELECTRIC PLANT FOR WESTERN AUSTRALIAN GOVERNMENT.—Tenders will be received by the government of West Australia until Aug. 15 for furnishing and installing at Freemantle, Australia, one 12,500-kw. turbo-alternator, complete with surface condensing plant, water-tube boilers, economizer, fans, chimney, etc., and also a coal and ash plant. Tenders are to be addressed to the Agent General for Western Australia, Savoy House, Strand, London, W.C.W. Further information may be obtained on application to William H. Taylor, general manager and engineer of the Western Australian Government Electricity Supply, at the above address.

ELECTRIC LIFTS FOR NEW DELHI, INDIA.—The Chief Controller of Stores, Indian Stores Department (Engineering Department), Simla, India, will receive tenders until August 12 as follows: (1) For five passenger, three freight and seven small service electric elevator for the government house at New Delhi; (2) for six passenger, one freight and four small service electric elevators for the Legislative Council Building, New Delhi.

BUSHING INSULATORS FOR MORWELL (AUSTRALIA) POWER SCHEME. —Tenders will be received by the State Electricity Commission of Victoria, Melbourne, Australia, until Sept. 15 for bushing insulators for 6,600-volt trifurcating boxes (specification No. 24/38) for the Morwell power scheme. For details see Searchlight Section.

PROPOSED YALU RIVER (CHINA) HYDRO-ELECTRIC SCHEME. — A company, it is stated, has been formed for the purpose of carrying out a project for utilizing the water power of Yalu River to generate electricity. It is proposed to supply electricity to Autung and New Wiju. The power will also be used to operate an electric railway to be built between Mudken and Hsingking.

PROPOSED IRRIGATION AND POWER DEVELOPMENTS ON THE CAUVERY RIVER, INDIA.—Through the settlement of the dispute over the partition of the waters of the Cauvery River in India by the government of Madras and the native State of Mysore the development of irrigation and power projects on Cauvery River, *Commerce Reports* states, has been made possible. The Madras government will construct the Mettur reservoir, storing 8,000,000,000 cu.ft. of water for irrigation purposes, and the State of Mysore will proceed with the construction of the Kannambada dam, the water to be used partly for irrigation purposes and partly for increased power facilities for the Mysore Electrical Department.

New Incorporations

THE LEE CO-OPERATIVE ELECTRIC LIGHT LINE, Fort Mill, S. C., has filed articles of incorporation, with B. M. Lee, president, and S. A. Lee, secretary.

THE SALLEY (S. C.) LIGHT & POWER COMPANY has been granted a charter. The officers are H. O. Jones, president, and G. L. Kennedy, secretary.

THE ST. LAWRENCE VALLEY POWER CORPORATION, Potsdam, N. Y., has been incorporated with a capital stock of $5,750,000. The company is a consolidation of the St. Lawrence River Power Corporation and the Hanna Falls Water Power Company. The directors are F. A. Stoughton, A. W. Andrews and Paul B. Murphy, all of Potsdam.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

BOSTON, MASS.—The Edison Electric Illuminating Company plans to build an addition to its power plant on Glenville Terrace, near Harvard Avenue, Allston.

HOLYOKE, MASS.—The Holyoke Water Power Company has authorized an increase in capital from $1,200,000 to $3,000,000, part of the proceeds to be used for expansion.

HOPEDALE, MASS.—The Draper Corporation has plans under way for the complete electrification of its machinery manufacturing plant. Electricity will be furnished by the New England Power Company. John A. Stevens, 8 Merrimack Street, Lowell, is engineer.

WATERBURY, CONN.—The Connecticut Light & Power Company has foundations laid for a substation on Silver Street.

Middle Atlantic States

BROOKLYN, N. Y.—Bids will be received by the office of the signal supply officer, War Department, General Intermediate Depot, Fifty-eighth Street and First Avenue, until July 10, for 1,000,000 ft. of wire.

LAKEWOOD, N. Y. — The taxpayers have authorized the Village Board to enter into a contract for street lighting for a period of five years, the cost not to exceed $5,000.

PERRYSBURG, N. Y.—Bids will be received by John H. Meahl, Commissioner of Parks and Public Buildings, Buffalo, until July 8 for the installation of an ash-handling system at the power house of the J. N. Adam Memorial Hospital. Plans and specifications on file at Room 6, Municipal Building, Buffalo.

STATEN ISLAND, N. Y.—Bids will be received by the Superintendent of Lighthouses until July 7 for four 110-volt generator sets (Proposal 17,363).

WESTFIELD, N. Y.—The Electric Light Commission contemplates erecting about 4 miles of rural distribution lines during this year. Harry Mettendorf is superintendent.

ATLANTIC CITY, N. J.—Electric power equipment with switchboard, motor-driven pumping apparatus, etc., will be installed in the proposed hotel to be erected at the Boardwalk, Providence and Boston Avenues, to cost about $3,700,000. Maynicke & Franke, 25 East Twenty-sixth Street, New York, are architects.

NEWARK, N. J.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 25 for lighting changes in the United States post office and custom house, Newark, N. J. For details see Searchlight Section.

ERIE, PA.—The City Council is considering an issue of $20,000 in bonds for the installation of a high-tension conduit system in Twelfth Street. The construction of a low-tension conduit system in Tenth Street from Wayne Street to Payne Avenue, to cost about $14,000, is under consideration.

HOLTWOOD, PA.—A new company, known as the Holtwood Power Company, has been organized by interests connected with the Consolidated Gas, Electric Light & Power Company, Baltimore, and the Pennsylvania Water & Power Company to build a new steam power plant at Holtwood. It will adjoin the 150,000-hp. hydro-electric plant of the Pennsylvania Water & Power Company. The plans provide for an initial installation of 30,000 hp. with an ultimate output of 125,000 hp. The last-named company has contracted for the entire output of the plant. C. E. F. Clarke is president of the new company.

HYDETOWN, PA.—The Hydetown Light & Power Company, now being organized by F. E. Harshaw, George W. Crowley, Jr., and associates, will erect and operate a transmission system in this vicinity. The same interests have also formed the Dudley Light & Power Company to construct and

operate transmission lines at Dudley. Both companies are represented by James C. Jones, Bullitt Building, Philadelphia.

JOHNSTOWN, PA.—Plans are under way by the Penn Public Service Corporation for rebuilding the transmission lines in and around the towns of Corry and Spring Creek.

OIL CITY, PA.—The Citizens' Traction Company is reported to have engaged Day & Zimmermann, Inc., 1,600 Walnut Street, Philadelphia, to prepare plans for doubling the output of its West End power plant. Order has been placed for a 500-hp. boiler, and a 7,500-kw. turbine will be purchased.

PITTSBURGH, PA. — The Hampton, O'Hara, Indiana and Harmar Township Light companies, organized by local interests, represented by A. W. Robertson and J. R. McNary, 435 Sixth Avenue, attorneys, plan to erect transmission lines in

WEST CHESTER, PA. — The London Britain Township Light & Power Company and the Elk Township Light & Power Company, recently organized by Henry P. Carr, Walter W. Perkins and associates, will erect and operate transmission lines in the respective counties for which they are named. The companies are represented by Gill, Guckes & Shrader, attorneys, Real Estate Trust Building, Philadelphia.

CHARLESTON, W. VA.—The Virginia Power Company plans to erect a new high-tension transmission line from Cabin Creek through Huntington to Portsmouth, to cost from $1,500,000 to $2,000,000. The new line will carry 132,000 volts or 200,000 volts, while the present line between Cabin Creek and Huntington carries only 44,000 volts. The company is planning to build a new hydro-electric plant on New River at Hinton, for which permit has been granted by the Federal Power Commission. The company is reported to have purchased the property of the Portsmouth (Va.) Public Service Corporation.

CHELYAVAN, W. VA.—The Chelyavan Electric, Water & Ice Company plans to erect an electric transmission line.

MOUNDSVILLE, W. VA.—The Fostoria Glass Company, Inc., it is reported, contemplates the purchase of a new electric generating unit in connection with extensions and improvements to its power plant.

WASHINGTON, D. C.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until July 18 for air compressor, insulated wire, brushes, etc., as per circular No. 1,618.

WASHINGTON, D. C.—Bids will be received by the bureau of supply, Treasury Department, until July 7, for electrical supplies, including sockets and socket bushings, switches, receptacles, etc. (Circular 3367).

WASHINGTON, D. C.—Bids will be received by the chief signal officer, United States Army, until July 7, for 1,200 transmitting vacuum-tube sockets and 900 receiving vacuum tube sockets (Circular C.P. 18250-1); also, until July 9, for 15 decremeters (Circular C.P. 18258-1).

North Central States

BESSEMER, MICH.—The City Council is considering the construction of a power dam municipal hydro-electric plant on the Black River, near Ramsay, for local light and power service.

DETROIT, MICH.—The Detroit, Toledo & Ironton Railroad contemplates the electrification of its system, using overhead feeder line. A number of substations and transmission lines will be built.

PETOSKEY, MICH.—Plans are under consideration by the City Council for completing the rebuilding of the municipal light and power plant and combining it with the city waterworks plant. The proposed new building will occupy the site of the present waterworks station.

DEFIANCE, OHIO.—The Toledo Edison Company has secured permission to acquire the properties of the Defiance Gas & Electric Company, the Swanton Light & Power Company and the Holgate Light & Power Company. Authority has also been given to issue $2,267,200, in capital stock, part of the fund to be used for extensions.

KENT, OHIO.—Steps have been taken by the Kent Chamber of Commerce for the installation of an ornamental lighting system on portions of West Main, East Main and North Water Streets and on South Water Street.

TIFFIN, OHIO.—The installation of an ornamental lighting system is under consideration. The plans call for sixty-four lamps on Washington Street and sixty-four on four intersecting streets.

TOLEDO, OHIO.—The stockholders of the Toledo Edison Company have approved an increase of capital stock of $6,000,000, part of the proceeds to be used for future expansion.

MOORESVILLE, IND.—Bids will be received by the Board of School Trustees until July 11 for the construction of a central power house for local schools. W. H. Garns, Fletcher Trust Building, Indianapolis, is architect.

CHICAGO, ILL.—The Public Service Company of Northern Illinois has issued a block of preferred stock, the proceeds to be used for additions to its system. A total fund of $10,000,000 will be arranged for the work.

CHICAGO HEIGHTS, ILL.—The trustees of the St. James Hospital, 1,423 Chicago Road, contemplate building a power house and an addition to the hospital, to cost about $600,000.

HANCOCK, WIS.—Preparations are being made by Dahlke, Giese & Walker to erect a transmission line from Wautoma to Hancock, a distance of 15 miles. Electric service will be supplied to rural communities along the line. Following the completion of this line, plans are contemplated for the erection of two lines from Hancock, one on the north to Plainfield, about 10 miles, and one to the south to Coloma, a distance of 10 miles.

MILWAUKEE, WIS.—The City Council is considering a resolution providing for the installation of a new street-lighting system on Seventeenth, Eighteenth, Nineteenth and West Nineteenth Streets between Franklin Street and Atkinson Avenue and on Ninth, Tenth, Eleventh and Twelfth Streets and Louis Avenue between Albert Place and Lake Street.

RHINELANDER, WIS.—Extensions contemplated by the Rhinelander Paper Company, to cost about $50,000, include increasing its water supply and the generating capacity of its hydro-electric plant.

SUPERIOR, WIS.—The installation of an ornamental lighting system on Belknap Street from Tower Avenue to Weeks Avenue is under consideration by business men and property owners.

WEYERHAUSER, WIS.—The local electric plant has been purchased by the Lake Superior Power Company, Ashland. Improvements are contemplated by the new owner, including the erection of a transmission line from Bruce to Weyerhauser, a distance of 10 miles, to furnish electricity here.

BUHL, MINN.—Plans are under way for extensions and improvements to the municipal electric light and power plant, to cost about $30,000. Charles Foster, Duluth, is engineer.

DULUTH, MINN.—The Pike Rapids Power Company, Duluth, has applied to the Federal Power Commission for a permit to build a power dam in the Mississippi River above the mouth of Christy Brook.

FERGUS FALLS, MINN.—The Bonita Electric Company, recently organized, plans to erect a transmission line from Battle Lake to Ottertail Lake. A. G. Anderson is president.

McCAUSLAND, IOWA.—The Hawkeye Electric Power Company is extending its high-tension line to McCausland, Gambril and Fairyland Park, to serve electricity in McCausland and to farmers and resorts on the Wapsie River.

MILLER, MO.—The Council has issued $13,000, in bonds, the proceeds to be used for the erection of a transmission line to supply electricity for light and power service.

VIENNA, MO. — The Central Missouri Power & Water Company, Kansas City, has secured a preliminary permit for two hydro-electric power developments on the Gasconade River, near Vienna and Waynesville, respectively. The two plants will have a combined capacity of about 55,000 hp.

MILLER, S. D.—Improvements are contemplated to the municipal electric power plant, to cost about $4,000. The work will include extension to the power house and installation of a new boiler.

WEEPING WATER, NEB.—The installation of an ornamental lighting system is under consideration by the Council.

CAMBRIDGE, KAN.—Bids will be received by the Council until July 9 for the erection of a transmission line for municipal service. W. B. Rollins & Company, Railway Exchange Building, Kansas City, Mo., are engineers.

Southern States

GREENSBORO, N. C.—The City Council plans to install an electric fire-alarm system, to cost about $20,000. Simmonds & Sawyer, Greensboro, are architects.

MOUNT GILEAD, N. C.—The Carolina Power Company, Raleigh, has been granted a sixty-year franchise and will take over the local system of the Smitherman Power Company, Troy.

OXFORD, N. C.—Bids will be received by the City Council until July 10 for electrically operated pumping equipment, etc., for the proposed waterworks. William C. Olsen, Masonic Temple Building, Raleigh, is engineer.

WILMINGTON, N. C.—The Tidewater Power Company has issued $1,070,500 in bonds, part of the proceeds to be used for extensions and improvements in its system.

ANDERSON, S. C.—The Southern Public Utilities Company has received authority to extend its suburban power lines.

SALLEY, S. C., The Salley Light & Power Company, recently organized, plans to install a local light and power system. A transmission line will be built. G. L. Kennedy is secretary.

ATLANTA, GA.—The Washington Land Company is reported to have purchased the property on the Savannah River, known as Hatton Shoals, with a view of utilizing it for a hydro-electric development in the future.

ATLANTA, GA.—The Georgia Railway & Power Company has applied to the Public Service Commission for permission to issue $3,000,000 in bonds, the proceeds to be used for the completion of several of the hydro-electric projects in the vicinity of Tugalo, Tallulah and Burton dams. Following the completion of the Terrora development, work will begin on the Nacoochee dam and power plant to be built between Burton and Terrora on the Tallulah River.

BARTOW, FLA.—The city authorities have made arrangements to extend the lines of the municipal electric plant to Homeland, 4½ miles distant, to supply electricity for light and power in that community. Steps are now being taken to extend the Roux Mills line to Alturas to furnish electrical service there.

MIAMI BEACH, FLA.—The Miami Beach Electric Company, it is reported, plans to erect a new building at its plant, to cost about $75,000.

ST. PETERSBURG, FLA.—The Pinellas County Power Company contemplates building a new 6,000-kw. steam-driven power station this year. B. M. Latham is general manager.

COALMONT, TENN. — The Tennessee Coal Mining & Timber Company, recently organized, contemplates building a sawmill, power house and lumber mill at its proposed local works.

ANDALUSIA, ALA.—The City Council has granted the River Falls Power Company a franchise to distribute electricity in Andalusia.

DECATUR, ALA.—The Alabama Power Company has secured permission to build a 44,000-volt transmission line from Decatur to Hapgood, to cost about $350,000. The erection of a line to Heflin from Oxford is also under consideration.

HEFLIN, ALA.—Negotiations are under way between local business men and the Alabama Power Company, Birmingham, with a view to the latter extending its transmission lines to Heflin to furnish electricity here.

HOUMA, LA.—A special election will soon be held to vote on the proposal to issue $100,000 in bonds, the proceeds to be used for extensions and improvements in the municipal electric plant and waterworks system.

LAFAYETTE, LA. — The House and Senate of General Assembly, State Legislature, recommend the adoption of House Concurrent Resolution 7, providing for improvements to the Southwestern Institute at Lafayette, to cost about $700,000. The plans include a central heating and power plant with laundry, etc., to cost about $75,000.

OAK GROVE, LA.—Bids will be received by the Board of Aldermen until July 8 for an electric light and water works plant. Henry A. Mentz, Magnolia, Miss., is consulting engineer.

TEXOLA, OKLA.—Bonds to the amount of $47,000 have been voted for an electric light plant and new waterworks system. The Grant Baker Company, 1116 West Main Street, Oklahoma City, is engineer.

GRAPELAND, TEX.—Arrangements are being made by the Texas Power & Light Company, Dallas, to extend its transmission line from Crockett to Grapeland.

CLARKSVILLE, TEX.—The Texas Power & Light Company is negotiating for the purchase of the property of the Clarksville Light Company and plans to erect a transmission line here.

Pacific and Mountain States

TACOMA, WASH.—The City Council has authorized the installation of an ornamental lighting system on Howard Street, to cost about $91,500.

TACOMA, WASH.—The three bids submitted for the construction of power house for the Lake Cushman power project have been rejected and new bids will be called for at once.

COQUILLE, ORE.—The Alpine Paper Company contemplates the construction of a power house at its proposed local paper and pulp mill, to cost about $500,000.

WOODBURN, ORE.—Plans for the proposed training school for boys to be erected at Woodburn include a steam-driven electric power plant. It will also be equipped with manual training equipment. The entire cost is estimated at about $175,000. W. C. Knighton, United States Bank Building, Portland, is architect.

MERCED, CAL.—The Merced Irrigation District has rejected bids submitted for construction of hydro-electric plant, including dam, power house and railroad.

SAN FRANCISCO, CAL.—The Pacific Gas & Electric Company has applied to the Railroad Commission for permission to sell $5,000,000 in capital stock at not less than $92 per share, the proceeds to be used to finance improvements on the Mount Shasta projects and elsewhere.

SAN FRANCISCO, CAL.—Arrangements have been made between the Pacific Gas & Electric Company and the Nevada Irrigation District for a joint hydro-electric and irrigation project in Nevada and Placer Counties, involving an expenditure of about $8,000,000. Joint application has been made by the companies to the Railroad Commission for approval of the agreement.

VALLEJO, CAL.—The navy supply officer, Mare Island navy yard, has been authorized to purchase 8,280 ft. fiber conduit (N.S.A. req. 2294).

DENVER, COL.—The Public Service Company of Colorado has taken out a permit for the construction of a substation at West Thirtieth Avenue and Howard Place, to cost about $90,000.

SHIPROCK, N. M.—Bids will be received by the United States Indian Agent, San Juan Agency, until July 10, for transmission line and material for work at the old San Juan Hospital; also for miscellaneous electrical supplies, fixtures, etc., for the summer school at this post.

Canada

CAMPBELLTON, N. B.—The Council has contracted with the Lower St. Lawrence Power Company, Ltd., Rimouski, Que., for additional power supply for the municipal electric system for a period of twenty years. Under the terms of the contract made with the Matapedia Valley Light & Power Company, as intermediary, the town will erect a 66,000-volt transmission line to the Quebec-New Brunswick boundary line at Matapedia. Upon completion of the project extensive improvements will be made to the local distribution system.

NIAGARA FALLS, ONT.—The City Council is considering a scheme for the illumination of the Falls. The cost of installation and upkeep for two years is estimated at $60,000. T. S. Scott is city manager.

TORONTO, ONT.—Tenders will be received by W. W. Hiltz, Mayor, chairman of board of control, City Hall, until Aug. 19 for furnishing and installing one 400-hp. steam turbine and accessories.

TORONTO, ONT.—The Electric Commissioners of Toronto contemplate building a substation on Wiltshire Avenue, to cost about $320,000.

TORONTO, ONT.—The City Council has granted the Toronto Hydro-Electric System permission to expend another $3,000,000 for extensions to its system. The bylaw authorizing an issue of $2,000,000 in bonds to enable the Hydro-Electric Power Commission of Ontario to proceed with the reconstruction of the York Radiol lines has been approved by the City Council.

MOOSE JAW, SASK.—The City Commissioners have applied for permission to issue $140,000 in bonds for the purchase of a new 3,500-kw. generating unit for the municipal electric light and power plant.

RADVILLE, SASK.—Bids will be received until July 15 by the town of Radville for the installation of a municipal electric plant of about 100 hp. capacity. A. A. Murphy, Saskatoon, is engineer.

Electrical Patents

Announced by U. S. Patent Office

(Issued May 27, 1924)

1,495,814. PREVENTION OF OVERHEATING OF IRONS AND OTHER ELECTRICALLY HEATED APPLIANCES; C. A. Simpson, Christchurch, N. Z. App. filed March 3, 1923.

1,495,823. ELECTRICAL COIL AND METHOD OF MAKING THE SAME; C. R. Underhill, New Haven, Conn. App. filed Jan. 14, 1921. To obtain complete impregnation.

1,495,827. SELF-STARTING SYNCHRONOUS MOTOR; H. E. Warren, Ashland, Mass. App. filed Dec. 12, 1921. Miniature type, as used on recording instruments.

1,495,851. CARBON BRUSH FOR DYNAMO-ELECTRIC MACHINES; W. W. Jarvis, Battersea, London, England. App. filed Feb. 21, 1921. With insulated pigtail.

1,495,855. RESISTANCE ROD; G. M. Little, Pittsburgh, Pa. App. filed Dec. 16, 1920. For use in lightning arresters.

1,495,856. ELECTRIC RESISTANCE ROD-ANNEALING FURNACE; G. M. Little, Pittsburgh, Pa. App. filed March 23, 1922. Multiple-chamber type.

1,495,861. INDUCTION MOTOR; C. MacMillan, Schenectady, N. Y. App. filed Aug. 4, 1921. Squirrel-cage.

1,495,926. SUBMARINE AND LONG-DISTANCE TELEPHONE SYSTEM AND METHOD OF OPERATING THE SAME; L. Reilstab, Zeist, near Utrecht, Netherlands. App. filed July 8, 1922.

1,495,936. MOTOR DRIVE; H. E. Warren, Ashland, Mass. App. filed April 12, 1922. Using a self-starting synchronous motor of the miniature type.

1,495,947. SPEED-REGULATOR SYSTEM; C. A. Boddie, Pittsburgh, Pa. App. filed Dec. 3, 1919. For governing electric motors.

1,495,958. FILM HOLDER FOR DENTAL PURPOSES; D. J. Machol, West New Brighton, N. Y. App. filed Feb. 18, 1922.

1,495,969. DOUBLE SQUIRREL-CAGE SYNCHRONOUS MOTOR; E. F. W. Alexanderson, Schenectady, N. Y. App. filed March 23, 1920. Self-starting.

1,495,970. TRANSMITTER; I. W. Bray and and F. E. Bronson, Reading, Mass. App. filed Oct. 25, 1920. For use in telephones and instruments to aid hearing.

(Issued June 3, 1924)

1,495,990. METHOD OF INTRODUCING PASTE INTO DRY-CELL CUPS; H. de Olaneta, New Haven, Conn. App. filed June 9, 1920.

1,495,992. MEANS FOR AND METHOD OF REDUCING SINGING IN REPEATERS; L. Espenschied, Queens, N. Y. App. filed June 17, 1921. Used in radio or wire transmission systems.

1,496,014. MULTICHANNEL CIRCUITS; H. S. Osborne, New York, N. Y. App. filed July 16, 1919. For signaling systems.

1,496,037. CONSTANT-VOLTAGE VARIABLE-SPEED GENERATOR; T. W. Varley, New York, N. Y. App. filed June 7, 1921. Third-brush type.

1,496,063. SIGNAL SYSTEM; D. J. McCarthy, Elgin, Ill. App. filed June 23, 1922. Applicable to polychrome signals as used on railways.

1,496,073. ELECTRIC POWER SYSTEM; F. M. Slough, Elyria, Ohio. App. filed Jan. 17, 1921. Farm-lighting type.

1,496,077. SOLDERING IRON; W. A. Whipple, Chicago, Ill. App. filed June 14, 1923.

1,496,136. MAGNETIC AND FLUID REGULATION OF ELECTRIC CURRENT; C. H. Smoot, New York, N. Y. App. filed Nov. 19, 1920. Means for correlating the pressures of a flow of fluid to the changes of electromagnetic forces derived from the electric current to be regulated.

1,496,155. ART OF RADIO COMMUNICATION; F. J. Fransson, Short Hills, N. J. App. filed Nov. 8, 1919. Duplex system of wireless telegraphy or telephony in which waves or messages may be simultaneously transmitted and received from a single antenna without mutual interference.

1,496,214. RADIOTELEGRAPHY TRANSMISSION SYSTEM; L. F. Fuller and H. F. Elliott, Palo Alto, Cal. App. filed May 22, 1919. Employing an arc radio generator of the Poulsen type.

1,496,218. VEHICLE LAMP; C. M. Hall, Detroit, Mich. App. filed Feb. 6, 1922. Combined tail and stop light.

1,496,230. APPARATUS FOR SMELTING PHOSPHATIC MATERIALS; B. G. Klugh, Anniston, Ala. App. filed Dec. 7, 1920. Electric furnace.

1,496,231. ELECTRIC SMELTING FURNACE CONSTRUCTION; B. G. Klugh, Chicago, Ill. App. filed March 23, 1922.

1,496,232. STOCK FEEDING AND DISTRIBUTING APPARATUS FOR ELECTRICAL FURNACES; B. G. Klugh, Chicago, Ill. App. filed April 3, 1922. Of the inclosed type.

1,496,243. RADIOTELEGRAPHY; F. S. McCullough, Cleveland, Ohio. App. filed July 7, 1919. Systems at receiving stations for determining the direction of incoming electromagnetic waves, so that the location of the transmitting station may be ascertained.

1,496,245. COMBINED ELECTRIC LIGHT SOCKET AND GLOBE OR SHADE HOLDER; N. W. Nutt, Trenton, N. J. App. filed Sept. 1, 1921.

1,496,249. TELEPHONE RECEIVER; J. S. Timmons, Philadelphia, Pa. App. filed May 19, 1922.

1,496,254. VARIABLE ELECTROLYTIC RESISTANCE; S. G. Brown, North Acton, England. App. filed Jan. 11, 1921.

1,496,275. RADIO TRANSMITTING APPARATUS; P. Laut, Paris, France. App. filed Oct. 18, 1920.

1,496,276. WIRELESS TELEGRAPHY AND TELEPHONE RECEIVING SET; H. P. Rees, Ealing, London, England. App. filed Aug. 9, 1921.

1,496,294. AUTOMATIC ELECTRIC TRAIN-LINE COUPLING; T. R. Brown, Pittsburgh, Pa. App. filed July 5, 1918.

1,496,299. ELECTRIC FURNACE; H. E. Clifford, Newton, Mass. App. filed Oct. 4, 1921. In which a rotating magnetic field is set up in addition to those caused by the electrodes.

1,496,311. RECEIVING SYSTEM FOR RADIANT ENERGY; J. H. Hammond, Jr., Gloucester, Mass. App. filed Oct. 17, 1917. Designed for use upon a torpedo for steering the torpedo from a distance.

1,496,318. REGULATION OF ASYNCHRONOUS MACHINE; J. Kozisek, Berlin-Charlottenburg, Germany. App. filed Aug. 8, 1921.

1,496,333. ARC-WELDED PIPE COUPLING; W. F. Woodlard, Wauwatosa, Wis. App. filed July 28, 1923.

1,496,356. METHOD OF HEATING ROTARY CYLINDERS BY ELECTRICITY; W. J. Noonan, Mansfield, Mass. App. filed Nov. 13, 1922.

1,496,371. CONDENSER; C. B. Graves, Marblehead, Mass. App. filed Aug. 23, 1922. Variable.

1,496,372. ELECTRIC FIRE POT; W. S. Hadaway, Jr., New Rochelle, N. Y. App. filed March 24, 1922. For very high temperatures.

1,496,383. ELECTRICAL SPARK-PLUG-SHORTING DEVICE; A. B. Seppamann, Lake Crystal, Minn. App. filed April 4, 1923.

1,496,423. HEADBAND FOR TELEPHONE RECEIVERS; H. G. Leach, Brooklyn, N. Y. App. filed March 11, 1922.

1,496,433. METHOD OF AND MEANS FOR CONTROLLING ELECTRIC MOTORS; H. Rosenthal, Chicago, Ill. App. filed Dec. 29, 1919.

1,496,438. CAUTERIZER; G. W. Wallerich, Chicago, Ill. App. filed May 16, 1921.

1,496,440. ELECTRIC FURNACE; V. M. Weaver, Thorold, Ontario, Canada. App. filed March 11, 1918. Wherein it is necessary to maintain a reducing atmosphere for the purposes of decomposition preliminary to combination.

1,496,442. ELECTRICAL PEAK-VOLTAGE-CONTROL SYSTEM; E. H. Becker, Waterbury, and M. L. Martus, Woodbury, Conn. App. filed July 31, 1922. Adapted for use with copper oxide, soda and other batteries, for lighting incandescent lamps or operating other signal means for railroad signals.

1,496,449. DIMMING SWITCH; S. F. Briggs, Milwaukee, Wis. App. filed March 8, 1915. As used on automobiles.

1,496,457. FILAMENT AND LIKE BODIES; G. R. Fonda, Schenectady, N. Y. App. filed July 17, 1919. Whereby the disintegrating or evaporating tendency of the tungsten due to high temperature is materially reduced.

1,496,472. CONDUCTOR SUPPORT; H. V. Linderman, Mansfield, Ohio. App. filed April 27, 1923. For use with a trolley-wire clamp or ear.

1,496,484. HAND SIGNAL FOR MOTOR VEHICLES; A. R. Monaco, Los Angeles, Calif. App. filed July 5, 1922. Self-contained.

1,469,495. SEPARATOR; E. W. Shepherd, Chicago, Ill. App. filed May 15, 1922. Of wood, for use in a storage battery.

1,496,526, 1,496,527 and 1,496,528. PRODUCTION OF ELECTRODES FOR GALVANIC BATTERIES; H. N. Cox, Glen Ridge, N. J. App. filed Dec. 14, 1920.

1,496,552. INSULATION BLOCK AND ELECTRICAL CONSTRUCTION FOR THE TERMINALS OF ELECTRIC RANGES; R. H. MacInnes, Hamilton, Ontario, Canada. App. filed May 24, 1923.

1,496,554. SPARK-PLUG ATTACHMENT; A. Molnar, Jr., Jessup, Pa. App. filed Nov. 10, 1921. For intensifying the spark and to make visible the operation.

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Printed in the First Issue of Each Volume

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